AN
HISTORY
OF THE
EARTH,
AND
ANIMATED NATURE.

BY OLIVER GOLDSMITH.

IN EIGHT VOLUMES.

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AN

AN HISTORY OF TESTACEOUS FISHES.

CHAP. I.

Of the Shell of Teſtaceous Fiſhes.

ONE is apt to combine very diſſimilar objects in the ſame groupe, when hurried into the vortex of method. No two animals are more unlike each other than the whale and the limpet, the tortoiſe and the oyſter. Yet, as theſe animals muſt find ſome place in the picture of animated nature, it is beſt to let them reſt in the ſtation where the generality of mankind have aſſigned them; and as they have been willing to give them all from their abode the name of fiſhes, it is wiſeſt in us to conform.

But before I enter into any hiſtory of ſhell-fiſh, it may not be improper to obſerve, that

naturalists who have treated on this part of history, have entirely attended to outward forms; and, as in many other instances, forsaking the description of the animal itself, have exhausted all their industry in describing the habitation. In consequence of this radical error, we have volumes written upon the subject of shells, and very little said on the history of shell-fish. The life of these industrious creatures, that for the most part creep along the bottom, or immoveably wait till driven as the waves happen to direct, is almost entirely unknown. The wreathing of their shells, or the spots with which they are tinctured, have been described with a most disgusting prolixity; but their appetites and their combats, their escapes and humble arts of subsistence, have been utterly neglected.

As I have only undertaken to write the history of animated nature, the variety of shells, and their peculiar spots or blemishes, do not come within my design. However, the manner in which shells are formed is a part of natural history connected with my plan, as it pre-supposes vital force or industry in the animal that forms them.

The shell may be considered as an habitation supplied by nature. It is an hard stony substance, made up somewhat in the manner of a

wall. Part of the ſtony ſubſtance the animal derives from outward objects, and the fluids of the animal itſelf furniſh the cement. Theſe united make that firm covering which ſhell-fiſh generally reſide in till they die.

But, in order to give a more exact idea of the manner in which ſea-ſhells are formed, we muſt have recourſe to an animal that lives upon land, with the formation of whoſe ſhell we are beſt acquainted. This is the garden-ſnail, that carries its box upon its back, whoſe hiſtory Swammerdam has taken ſuch endleſs pains to deſcribe. As the manner of the formation of this animal's ſhell extends to that of all others that have ſhells, whether they live upon land or in the water, it will be proper to give it a place before we enter upon the hiſtory of teſtaceous fiſhes.

To begin with the animal in its earlieſt ſtate, and trace the progreſs of its ſhell from the time it firſt appears.—The inſtant the young ſnail leaves the egg, it carries its ſhell or its box on its back. It does not leave the egg till it is arrived at a certain growth, when its little habitation is ſufficiently hardened. This beginning of the ſhell is not much bigger than a pin's head, but grows in a very rapid manner, having at

first but two circumvolutions, for the rest are added as the snail grows larger. In proportion as the animal encreases in size, the circumvolutions of the shell encrease also, until the number of those volutes come to be five, which is never exceeded.

The part where the animal enlarges its shell is at the mouth, to which it adds in proportion as it finds itself stinted in its habitation below. Being about to enlarge its shell, it is seen with its little teeth biting and clearing away the scaly skin that grows at the edges. It is sometimes seen to eat those bits it thus takes off; at other times it only cleans away the margin when covered with films, and then adds another rim to its shell.

For the purposes of making the shell, which is natural to the animal, and without which it could not live three days, its whole body is furnished with glands, from the orifices of which flows out a kind of slimy fluid, like small spiders threads, which join together in one common crust or surface, and in time condense and acquire a stony hardness. It is this slimy humour that grows into a membrane and afterwards a stony skin; nor can it have escaped any who have observed the track of a snail; that glistening substance

which it leaves on the floor or the wall is no other than the materials with which the animal adds to its shell, or repairs it when broken.

Now to exhibit in a more satisfactory manner the method in which the shell is formed,—The snail bursts from its egg with its shell upon its back; this shell, though very simple, is the center, round which every succeeding convolution of the shell is formed, by new circles added to the first. As the body of the snail can be extended no where but to the aperture, the mouth of the shell only can of consequence receive augmentation. The substance of which the shell is composed is chiefly supplied by the animal itself, and is no more than a slimy fluid which hardens into bone. This fluid passes through an infinite number of little glands till it arrives at the pores of the skin; but there it is stopped by the shell that covers the part below; and therefore is sent to the mouth of the shell, where it is wanted for its enlargement. There the first layer of slime soon hardens; and then another is added, which hardens also, till in time the shell becomes as thick as is requisite for the animal's preservation. Thus every shell may be considered as composed of a number of layers of slime, which have entirely proceeded from the animal's own body.

But though this be the general opinion with regard to the formation of ſhells, I cannot avoid thinking there are ſtill other ſubſtances beſide the animal's own ſlime which go to the compoſition of its ſhell, or at leaſt to its external coat, which is ever different from the internal. The ſubſtances I mean are the accidental concretions of earthy or ſaline parts, which adhere to the ſlimy matter upon its firſt emiſſion. By adopting this theory, we can more ſatisfactorily account for the various colours of the ſhell, which cannot be ſuppoſed to take its tincture from the animal's body, as is the uſual opinion; for all the internal parts of the ſhell are but of one white colour; it is only the outermoſt layer of the ſhell that is ſo beautifully varied, ſo richly tinctured with that variety of colours we behold in the cabinets of the curious. If the external coat be ſcaled off, as Mr. Argenville aſſerts, all the inner ſubſtance will be found but of one ſimple colouring; and conſequently the animal's own juices can give only one colour; whereas we ſee ſome ſhells ſtained with an hundred.

The uſual way of accounting for the different colouring of ſhells, which ſeems to me erroneous, is this. In the body of every one of theſe animals, ſeveral ſtreaks are diſcerned of a different

colour from the reſt. This variety, ſay they, is an inconteſtible proof that the juices flowing from thoſe parts will be alſo of a different hue; and will conſequently tinge that part of the ſhell which their ſlime compoſes of a different colour. But this ſyſtem, as was obſerved before, is overthrown by the fact, which diſcovers that only the outer ſurface of the ſhell is tinged; whereas, by this, it would have been coloured throughout: nay, by this ſyſtem, the internal parts of the ſhell would be ſtained with the moſt vivid colouring, as being leaſt expoſed to the external injuries of the element where it is placed. But the truth is, the animal reſiding in the ſhell has none of theſe various colours thus talked of: its ſlime is a ſimple pellucid ſubſtance; and the only marblings which appear in its body, are the colour of the food, which is ſeen through its tranſparent inteſtines. We muſt, therefore, account for the various colouring of its ſhell upon a different principle.

If, as I ſaid, we examine the cabinets of the curious, we ſhall find ſhells with various and beautiful colouring; we ſhall find them generally furniſhed with a white ground, tinctured with red, yellow, brown, green, and ſeveral other ſhades, and lovely mixtures, but never blue: Shells are of almoſt all colours but blue.

The reafon feems to be obvious; for blue is the colour which fea-water changes. A piece of filk, or a feather, of this colour, put into an infufion of falt, urine, or nitre, lofe their tint entirely. Now may not this give us a hint with refpect to the operation of nature in colouring her fhells? May we not from hence conclude, that fea-water is efficacious in giving colour or taking it away? That, to produce colour, the animal not only furnifhes its juices, but the fea or the earth that mixture of fubftance which is to unite with them. Neither the animal flime alone, nor the external earthy or faline fubftances alone, could produce colours; but both united, produce an effect which neither feparately was poffeffed of. Thus fhells affume every colour but blue; and that fea-water, inftead of producing, would be apt to deftroy.

From hence, therefore, it appears, that the animal does not alone tincture its own fhell; but that external caufes co-operate in contributing to its beauty It is probable that, from the nature of its food, or from other circumftances unknown to us, the external layers of its flime may be of different confiftencies; fo as, when joined with the particles of earth or falt that are accidentally united with them from without,

they aſſume various and beautiful hues. But the internal layers, which receive no foreign admixture, ſtill preſerve the natural colour of the animal, and continue white without any variation.

Thus far we ſee that the animal is not wholly the agent in giving beauty and colouring to its ſhell: but it ſeems otherwiſe with reſpect to its convolutions, its prominences, and general form. Theſe entirely depend upon the art of the animal; or rather upon its inſtincts; which, in the ſame kinds, are ever invariable. The ſhell generally bears ſome rude reſemblance to the body upon which it has been moulded. Thus it is obſervable in all ſea-ſhells, that if the animal has any tumour or excreſcence on its body, it creates likewiſe a ſwelling in that part of the incruſtation to which it correſponds. When the animal begins to alter its poſition, and to make new additions to its apartments, the ſame protuberance which had raiſed the ſhell before in one part, ſwells it again at ſome little diſtance; by which means we ſee the ſame inequality, in a ſpiral line, all round the ſhell. Sometimes theſe tumours of the animal are ſo large, or ſo pointed, that thoſe which riſe over them in the incruſtation, appear like horns; after this the animal diſengages itſelf from its

firſt cavities, and then, by freſh evacuations, aſſumes a new ſet of horns; and ſo encreaſes the number in proportion to its growth. If, on the other hand, the body happens to be chanelled, the ſhell that covers it will be chanelled likewiſe; if there be any protuberances in the body, which wind in a ſpiral line about it, the ſhell will likewiſe have its tumours and cavities winding round to the end.

In this manner, as the animals are of various forms, the ſhells exhibit an equal variety. Indeed, the diverſity is ſo great, and the figures and colours ſo very ſtriking, that ſeveral perſons, with a kind of harmleſs indolence, have made the arrangement of them the ſtudy and the buſineſs of their lives. Thoſe who conſult their beauty alone, take care to have them poliſhed, and to have an external cruſt, or perioſteum, as Swammerdam calls it, ſcoured off from their ſurfaces by ſpirit of ſalt. But there are others that, with more learned affectation, keep them exactly in the ſtate in which they have been found, with their precious cruſt ſtill round them. The expence men have ſometimes been at in making ſuch collections, is amazing; and ſome ſhells, ſuch as the Stairs ſhell or the Admiral ſhell, are not more precious for their ſcarceneſs, than pearls are for

their beauty. Indeed, it is the ſcarcity, and not the beauty, of the object that determines the value of all natural curioſities. Thoſe ſhells that offer but little beautiful to the ignorant, are often the moſt precious; and thoſe ſhells which an unlearned ſpectator would ſtop to obſerve with admiration, one accuſtomed to the viſitation of cabinets, would paſs over with diſdain. Theſe collections, however, have their uſe; not only by exhibiting the vaſt variety of Nature's operations, but alſo by exciting our curioſity to the conſideration of the animals that form them. A mind that can find innocent entertainment in theſe humble contemplations is well employed; and, as we ſay of children, is kept from doing miſchief. Although there may be nobler occupations than that conſidering the convolutions of a ſhell, yet there may be ſome who want the ambition to aſpire after ſuch arduous purſuits; there may be ſome unfit for them; there may be ſome who find their ambition fully gratified by the praiſe which the collectors of ſhells beſtow upon each other. Indeed, for a day or two, there is no mind that a cabinet of ſhells cannot furniſh with pleaſing employment. What can be more gratifying, as Pliny ſays*, than to view Nature in all her irregularities,

* Plin. ix. 33.

and ſporting in her variety of ſhells! Such a difference of colour do they exhibit; ſuch a difference of figure; flat, concave, long, lunated, drawn round in a circle, the orbit cut in two; ſome are ſeen with a riſing on the back, ſome ſmooth, ſome wrinkled, toothed, ſtreaked, the point variouſly intorted, the mouth pointing like a dagger, folded back, bent inwards: all theſe variations, and many more, furniſh at once novelty, elegance, and ſpeculation.

With reſpect to the figure of ſhells, Ariſtotle has divided them into three kinds; and his method is, of all others, the moſt conformable to nature. Theſe are, firſt, the Univalve, or Turbinated, which conſiſt of one piece, like the box of a ſnail; ſecondly, the Bivalve, conſiſting of two pieces, united by a hinge, like an oyſter; and thirdly, the Multivalve, conſiſting of more than two pieces, as the acorn-ſhell, which has not leſs than twelve pieces that go to its compoſition. All theſe kinds are found in the ſea at different depths; and are valuable in proportion to their ſcarceneſs or beauty.

From the variety of the colours and figure of ſhells, we may paſs to that of their place and ſituation. Some are found in the ſea; ſome in freſh water rivers; ſome alive upon land; and a ſtill greater quantity dead in the bowels of the

earth. But wherever shells are found, they are universally known to be composed of one and the same substance. They are formed of an animal or calcarious earth, that ferments with vinegar and other acids, and that burns into lime, and will not easily melt into glass. Such is the substance of which they are composed; and of their spoils, many philosophers think that a great part of the surface of the earth is composed at present. It is supposed by them, that chalks, marles, and all such earths as ferment with vinegar, are nothing more than a composition of shells, decayed, and crumbled down to one uniform mass.

Sea-shells are either found in the depths of the ocean, or they are cast empty and forsaken of their animals upon shore. Those which are fished up from the deep, are called by the Latin name Pelagii; those that are cast upon shore, are called Littorales. Many of the pelagii are never seen upon shore; they continue in the depths where they are bred; and we owe their capture only to accident. These, therefore, are the most scarce shells; and consequently, the most valuable. The littorales are more frequent; and such as are of the same kind with the pelagii are not so beautiful. As they are often empty and forsaken, and as

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their animal is dead and perhaps putrid in the bottom of the ſhell, they by this means loſe the whiteneſs and the brilliancy of their colouring. They are not unfrequently alſo found eaten through, either by worms, or by each other; and they are thus rendered leſs valuable: but what decreaſes their price ſtill more is, when they are ſcaled and worn by lying too long empty at the bottom, or expoſed upon the ſhore. Upon the whole, however, ſea-ſhells exceed either land or foſſil ſhells in beauty; they receive the higheſt poliſh, and exhibit the moſt brilliant and various colouring.

Freſh-water ſhells are neither ſo numerous, ſo various, or ſo beautiful as thoſe belonging to the ſea. They want that ſolidity which the others have: their clavicle, as it is called, is neither ſo prominent nor ſo ſtrong; and not having a ſaline ſubſtance to tinge the ſurface of the ſhell, the colours are obſcure. In freſh-water there are but two kinds of ſhells; namely, the bivalved and the turbinated.

Living land ſhells are more beautiful, though not ſo various as thoſe of freſh-water; and ſome not inferior to ſea-ſhells in beauty. They are indeed but of one kind, namely, the turbinated; but in that there are found four or five very beautiful varieties.

Of foffil, or, as they are called, *extraneous* fhells, found in the bowels of the earth, there are great numbers, and as great a variety. In this clafs there are as many kinds as in the fea itfelf. There are found the turbinated, the bivalve, and the Multivalve kinds; and of all thefe, many at prefent not to be found even in the ocean. Indeed, the number is fo great, and the varieties fo many, that it was long the opinion of naturalifts, that they were merely the capricious productions of Nature, and had never given retreat to animals whofe habitations they refembled. They were found, not only of various kinds, but in different ftates of prefervation: fome had the fhell entire, compofed, as in its primitive ftate, of a white calcarious earth, and filled with earth, or even empty; others were found with the fhell entire, but filled with a fubftance which was petrified by time; others, and thefe in great numbers, were found with the fhell entirely mouldered away, but the petrified fubftance that filled it ftill exhibiting the figure of the fhell; others ftill, that had been lodged near earth or ftone, impreffed their print upon thefe fubftances, and left the impreffion, though they themfelves were decayed: laftly, fome fhells were found half mouldered away, their parts fcaling off from each

other in the ſame order in which they were originally formed. However, theſe different ſtages of the ſhell, and even their fermenting with acids, were at firſt inſufficient to convince thoſe who had before aſſigned them a different origin. They were ſtill conſidered as accidentally and ſportively formed, and depoſited in the various repoſitories where they were found, but no way appertaining to any part of animated nature. This put ſucceeding enquirers upon more minute reſearches; and they ſoon began to find, that often where they dug up petrified ſhells or teeth, they could diſcover the petrified remains of ſome other bony parts of the body. They found that the ſhells which were taken from the earth, exhibited the uſual defects and miſchances, which the ſame kind are known to receive at ſea. They ſhewed them not only tinctured with a ſalt-water cruſt, but pierced in a peculiar manner by the ſea-worms, that make the ſhells of fiſhes their favourite food. Theſe demonſtrations were ſufficient at laſt to convince all but a few philoſophers who died away, and whoſe erroneous ſyſtems died with them.

Every ſhell, therefore, wherever it is found, is now conſidered as the ſpoil of ſome animal, that once found ſhelter therein. It matters not by what unaccountable means they may have

have wandered from the ſea; but they exhibit all, and the moſt certain marks of their origin. From their numbers and ſituation, we are led to conjecture, that the ſea reached the places where they are found; and from their varieties we learn how little we know of all the ſea contains at preſent; as the earth furniſhes many kinds which our moſt exact and induſtrious ſhell-collectors have not been able to fiſh up from the deep. It is moſt probable, that thouſands of different forms ſtill remain at the bottom unknown; ſo that we may juſtly ſay with the philoſopher: *Ea quæ ſcimus ſunt pars minima eorum quæ ignoramus.*

It is well, however, for mankind, that the defect of our knowledge on this ſubject is, of all parts of learning, that which may be moſt eaſily diſpenſed with. An encreaſe in the number of ſhells, would throw but very few lights upon the hiſtory of the animals that inhabit them. For ſuch information we are obliged to thoſe men who contemplated ſomething more than the outſide of the objects before them. To Reaumur we are obliged for examining the manners of ſome with accuracy; but to Swammerdam for more. In fact, this Dutchman has lent an attention to thoſe animals, that almoſt exceeds credibility: he has excelled even the

insects he dissected, in patience, industry, and perseverance. It was in vain that this poor man's father dissuaded him from what the world considered as a barren pursuit; it was in vain than an habitual disorder, brought on by his application, interrupted his efforts; it was in vain that mankind treated him with ridicule while living, as they suffered his works to remain long unprinted and neglected when dead: still the Dutch philosopher went on, peeping into unwholsome ditches, wading through fens, dissecting spiders, and enumerating the blood-vessels of a snail: like the bee, whose heart he could not only distinguish, but dissect, he seemed instinctively impelled by his ruling passion, although he found nothing but ingratitude from man, and though his industry was apparently becoming fatal to himself. From him I will take some of the leading features in the history of those animals which breed in shells; previously taking my division from Aristotle, who, as was said above, divides them into three classes: the Turbinated, or those of the Snail Kind; the Bivalved, or those of Oyster Kind; and the Multivalved, or those of the Acorn-shell Kind. Of each I will treat in distinct chapters.

CHAP.

E. Martin sculp.

A Turbinated Shell.

1 A Bivalve Shell. P. 41.

2 A Multivalve Shell. P. 61.

CHAP. II.

Of Turbinated Shell-Fiſh of the Snail Kind.

TO conceive the manner in which thoſe animals ſubſiſt that are hid from us at the bottom of the deep, we muſt again have recourſe to one of a ſimilar nature and formation, that we know. The hiſtory of the garden-ſnail has been more copiouſly conſidered than that of the elephant; and its anatomy is as well, if not better known: however, not to give any one object more room in the general picture of Nature than it is entitled to, it will be ſufficient to obſerve, that the ſnail is ſurprizingly fitted for the life it is formed to lead. It is furniſhed with the organs of life in a manner almoſt as complete as the largeſt animal; with a tongue, brain, ſalival ducts, glands, nerves, ſtomach, and inteſtines; liver, heart and blood-veſſels: beſides this, it has a purple bag that furniſhes a red matter to different parts of the body, together with ſtrong muſcles that hold it to the ſhell, and which are hardened, like tendons, at their inſertion.

But theſe it poſſeſſes in common with other animals. We muſt now ſee what it has peculiar to itſelf. The firſt ſtriking peculiarity is, that

the animal has got its eyes on the points of its largeſt horns. When the ſnail is in motion, four horns are diſtinctly ſeen; but the two uppermoſt and longeſt deſerve peculiar conſideration, both on account of the various motions with which they are endued, as well as their having their eyes fixed at the extreme ends of them. Theſe appear like two blackiſh points at their ends. When conſidered as taken out of the body, they are of a bulbous or turnip-like figure; they have but one coat; and the three humours which are common in the eyes of other animals, namely, the vitreous, the aqueous and the cryſtalline, are in theſe very indiſtinctly ſeen. The eyes the animal can direct to different objects at pleaſure, by a regular motion out of the body; and ſometimes it hides them, by a very ſwift contraction into the belly. Under the ſmall horns is the animal's mouth; and though it may appear too ſoft a ſubſtance to be furniſhed with teeth, yet it has not leſs than eight of them, with which it devours leaves, and other ſubſtances, ſeemingly harder than itſelf; and with which it ſometimes bites off pieces of its own ſhell.

But what is moſt ſurprizing in the formation of this animal, are the parts that ſerve for ge-

neration. Every ſnail is at once male and female; and while it impregnates another, is itſelf impregnated in turn. The veſſels ſupplying the fluid for this purpoſe, are placed chiefly in the fore part of the neck, and extend themſelves over the body; but the male and female organs of generation, are always found united, and growing together. There is a large opening on the right ſide of the neck, which ſerves for very different purpoſes. As an anus it gives a paſſage to the excrements; as a mouth it ſerves for an opening for reſpiration; and alſo as an organ of generation, it dilates when the deſire of propagation begins. Within this each animal has thoſe parts, or ſomething ſimilar thereto, which continue the kind.

For ſome days before coition, the ſnails gather together, and lie quiet near each other, eating very little in the mean time; but they ſettle their bodies in ſuch a poſture, that the neck and head are placed upright. In the mean time, the apertures on the ſide of the neck being greatly dilated, two organs, reſembling inteſtines, are ſeen iſſuing from them, which ſome have thought to be the inſtruments of generation. Beſide the protruſion of theſe, each animal is poſſeſſed of another peculiarity; for, from the ſame aperture, they launch forth

a kind of dart at each other, which is pretty hard, barbed, and ending in a very ſharp point. This is performed when the apertures approach each other; and then the one is ſeen to ſhoot its weapon, which is received by the other, though it ſometimes falls to the ground: ſome minutes after, the ſnail which received the weapon, darts one of its own at its antagoniſt, which is received in like manner. They then ſoftly approach ſtill nearer, and apply their bodies one to the other, as cloſely as the palms and fingers of the hands, when graſped together. At that time the horns are ſeen variouſly moving in all directions; and this ſometimes for three days together. The coupling of theſe animals is generally thrice repeated, at intervals of fifteen days each; and, at every time, a new dart is mutually emitted.

At the expiration of eighteen days, the ſnails produce their eggs, at the opening of the neck, and hide them in the earth with the greateſt ſolicitude and induſtry. Theſe eggs are in great numbers, round, white, and covered with a ſoft ſhell: they are alſo ſtuck to each other by an imperceptible ſlime, like a bunch of grapes, of about the ſize of a ſmall pea.

When the animal leaves the egg, it is ſeen with a very ſmall ſhell on its back, which has but one convolution; but in proportion as it

grows, the ſhell encreaſes in the number of its circles. The ſhell always receives its additions at the mouth; the firſt centre ſtill remaining: the animal ſending forth from its body that ſlime which hardens into a ſtony ſubſtance, and ſtill is faſhioned into ſimilar volutions. The garden ſnail ſeldom exceeds four rounds and an half; but ſome of the ſea ſnails arrive even at ten.

The ſnail, thus fitted with its box, which is light and firm, finds itſelf defended in a very ample manner from all external injury. Whenever it invaded, it is but retiring into this fortreſs, and waiting patiently till the danger is over. Nor is it poſſeſſed only of a power of retreating into its ſhell; but of mending it when broken. Sometimes theſe animals are cruſhed ſeemingly to pieces; and, to all appearance, utterly deſtroyed: yet ſtill they ſet themſelves to work, and in a few days, mend all their numerous breaches. The ſame ſubſtance by which the ſhell is originally made, goes to the re-eſtabliſhment of the ruined habitation. But all the junctures are very eaſily ſeen, for they have a freſher colour than the reſt, and the whole ſhell in ſome meaſure reſembles an old coat, patched with new pieces. They are ſometimes ſeen with eight or ten of theſe patches; ſo that

the damage muſt have been apparently irreparable. Still, however, though the animal is poſſeſſed of the power of mending its ſhell, it cannot, when come to its full growth, make a new one. Swammerdam tried the experiment: he ſtripped a ſnail of its ſhell, withour hurting any of the blood-veſſels, retaining that part of the ſhell where the muſcles were inſerted; but it died in three days after it was ſtripped of its covering: not, however, without making efforts to build up a new ſhell; for, before its death, it preſſed out a certain membrane round the whole ſurface of its body. This membrane was entirely of the ſhelly nature; and was intended, by the animal, as a ſupply towards a new one.

As the ſnail is furniſhed with all the organs of life and ſenſation, it is not wonderful to ſee it very voracious. It chiefly ſubſiſts upon the leaves of plants and trees; but is very delicate in its choice. When the animal moves to ſeek its food, it goes forward by means of that broad muſcular ſkin which ſometimes is ſeen projecting round the mouth of the ſhell; this is expanded before, and then contracted with a kind of undulating motion, like a man attempting to move himſelf forward by one arm, while lying on his belly. But the ſnail has another advantage, by which it not only ſmooths and planes its way, but alſo can aſcend in the

moſt perpendicular direction. This is by that ſlimy ſubſtance with which it is ſo copiouſly furniſhed, and which it emits wherever it moves. Upon this ſlime, as upon a kind of carpet, it proceeds ſlowly along, without any danger of wounding its tender body againſt the aſperities of the pavement; by means of this it moves upwards to its food upon trees; and by this deſcends, without danger of falling, and breaking its ſhell by the ſhock.

The appetite of theſe animals is very great; and the damage gardeners in particular ſuſtain from them, makes them employ every method for their deſtruction. Salt will deſtroy them, as well as ſoot; but a tortoiſe in a garden, is ſaid to baniſh them much more effectually.

At the approach of winter, the ſnail buries itſelf in the earth; or retires to ſome hole, to continue in a torpid ſtate, during the ſeverity of the ſeaſon. It is ſometimes ſeen alone; but more frequently in company in its retreat; ſeveral being uſually found together, apparently deprived of life and ſenſation. For the purpoſes of continuing in greater warmth and ſecurity, the ſnail forms a cover or lid to the mouth of its ſhell with its ſlime, which ſtops it up entirely, and thus protects it from every external danger. The matter of

which the cover is compofed, is whitifh, fomewhat like plaifter, pretty hard and folid, yet at the fame time porous and thin, to admit air, which the animal cannot live without. When the cover is formed too thick, the fnail then breaks a little hole in it, which corrects the defeet of that clofenefs, which proceeded from too much caution. In this manner, fheltered in its hole from the weather, defended in its fhell by a cover, it fleeps during the winter; and, for fix or feven months, continues without food or motion, until the genial call of fpring breaks its flumber, and excites its activity.

The fnail, having flept for fo long a feafon, wakes one of the firft fine days of April; breaks open its cell, and fallies forth to feek for nourifhment. It is not furprizing that fo long a faft fhould have thinned it, and rendered it very voracious. At firft, therefore, it is not very difficult in the choice of its food; almoft any vegetable that is green, feems welcome; but the fucculent plants of the garden are chiefly grateful; and the various kind of pulfe are, at fome feafons, almoft wholly deftroyed by their numbers. So great is the multiplication of fnails at fome years, that gardeners imagine they burft from the earth. A wet feafon is generally favourable to their production; for this animal

cannot bear very dry ſeaſons, or dry places, as they cauſe too great a conſumption of its ſlime, without plenty of which it cannot ſubſiſt in health and vigour.

Such are the moſt ſtriking particulars in the hiſtory of this animal; and this may ſerve as a general picture, to which the manners and habitudes of the other tribes of this claſs may be compared and referred. Theſe are, the ſea ſnail, of which naturaliſts have, from the apparent difference of their ſhells, mentioned fifteen kinds*; the freſh-water ſnail, of which there are eight kinds; and the land-ſnail, of which there are five. Theſe all bear a ſtrong reſemblance to the garden ſnail, in the formation of their ſhell, in their hermaphrodite natures, in the ſlimy ſubſtance with which they are covered, in the formation of their inteſtines, and the diſpoſition of the hole on the right ſide of the neck, which ſerves at once for the diſcharge of the fæces, for the lodging the inſtruments of generation, and for reſpiration, when the animal is under a neceſſity of taking in a new ſupply.

But in Nature, no two kinds of animals, however like each other in figure or conformation, are of manners entirely the ſame. Though the common garden ſnail bears a very ſtrong

* D'Argenville's Conchylioligie.

resemblance to that of fresh-water, and that of the sea, yet there are differences to be found, and those very considerable ones.

If we compare them with the fresh-water snail, though we shall find a general resemblance, yet there are one or two remarkable distinctions: and first, the fresh-water snail, and, as I should suppose, all snails that live in water, are peculiarly furnished with a contrivance by Nature, for rising to the surface, or sinking to the bottom. The manner in which this is performed, is by opening and shutting the orifice on the right side of the neck, which is furnished with muscles for that purpose. The snail sometimes gathers this aperture into an oblong tube, and stretches or protends it above the surface of the water, in order to draw in or expel the air as it finds occasion. This may not only be seen, but heard also by the noise which the snail makes in moving the water. By dilating this it rises; by compressing it, the animal sinks to the bottom. This is effected somewhat in the manner in which little images of glass are made to rise or sink in water, by pressing the air contained at the mouth of the tubes, so that it shall drive the water into their hollow bodies, which before were filled only with air, and thus make them heavier than the element in which they swim.

In this manner does the fresh-water snail dive or swim, by properly managing the air contained in its body.

But what renders these animals far more worthy of notice is, that they are viviparous, and bring forth their young not only alive, but with their shells upon their backs. This seems surprising; yet it is incontestably true: the young come to some degree of perfection in the womb of the parent; there they receive their stony coat; and from thence are excluded, with a complete apparatus for subsistence.

"On the twelfth of March," says Swammerdam, "I began my observations upon this "snail, and collected a great number of the "kind, which I put into a large bason filled with "rain-water, and fed for a long time with pot-"ter's earth, dissolved in the water about them. "On the thirteenth of the same month I opened "one of these snails, when I found nine living "snails in its womb: the largest of these were "placed foremost, as the first candidates for "exclusion. I put them into fresh-water, and "they lived to the eighteenth of the same "month, moving and swimming, like snails "full grown: nay their manner of swimming "was much more beautiful." Thus, at whatever time of the year these snails are opened,

they are found pregnant with eggs, or with living ſnails; or with both together.

This ſtriking difference between the freſh-water and the garden ſnail, obtains alſo in ſome of the ſea kind; among which there are ſome that are found viviparous, while others lay eggs in the uſual manner. Of this kind are one or two of the Buccinums; within which living young have been frequently found, upon their diſſection. In general, however, the reſt of this numerous claſs bring forth eggs; from whence the animal burſts at a proper ſtate of maturity, completely equipped with an houſe, which the moiſtneſs of the element where it reſides does not prevent the inhabitant from enlarging. How the ſoft ſlime of the ſnail hardens, at the bottom of the ſea, into the ſtony ſubſtance of a ſhell, is not eaſy to conceive. This ſlime muſt at leaſt be poſſeſſed of very powerful petrifying powers.

All animals of the ſnail kind, as was obſerved before, are hermaphrodites; each containing the inſtruments of generation double. But ſome of the ſea kinds copulate in a different manner from thoſe of the garden. The one impregnates the other; but, from the poſition of the parts, is incapable of being impregnated by the ſame in turn. For this reaſon it is ne-

ceſſary for a third to be admitted as a partner in this operation: ſo that, while one impregnates that before it, another does the ſame office by this; which is itſelf impregnated by a fourth. In this manner, Mr. Adanſon has ſeen vaſt numbers of ſea ſnails, united together in a chain, impregnating each other. The *bulin* and the *coret* perform the offices of male and the female at the ſame time. The orifices in theſe are two, both ſeparate from each other: the opening by which the animal performs the office of the male, being at the origin of the horns; that by which it is paſſive, as the female, being farther down upon the neck. It may alſo be obſerved as a general rule, that all animals that have this orifice, or verge, as ſome call it, on the right ſide, have their ſhells turned from the right to the left; on the contrary, thoſe which have it on the left ſide, have their ſhells turned from left to right, in a contrary direction to the former.

But this is not the only difference between land and ſea ſnails. Many of the latter entirely want horns; and none of them have above two. Indeed, if the horns of ſnails be furniſhed with eyes, and if, as ſome are willing to think, the length of the horn, like the tube of a teleſcope, aſſiſts viſion, theſe animals, that

chiefly reſide in the gloomy bottom of the deep, can have no great occaſion for them. Eyes would be unneceſſary to creatures whoſe food is uſually concealed in the darkeſt places; and who, poſſeſſed of very little motion, are obliged to grope for what they ſubſiſt on. To ſuch, I ſay, eyes would rather be an obſtruction than an advantage; and perhaps even thoſe that live upon land are without them!

Thoſe that have ſeen the ſhells of ſea ſnails, need not be told that the animal which produces them is larger than thoſe of the ſame denomination upon land. The ſea ſeems to have the property of enlarging the magnitude of all its inhabitants; and the ſame proportion that a trout bears to a ſhark, is often ſeen to obtain between a ſhell bred upon the land, and one breed in the ocean. Its convolutions are more numerous. The garden ſnail has but five turns at the moſt; in the ſea ſnail the convolutions are ſometimes ſeen amounting or ten.

There is a difference alſo in the poſition of the mouth, in the garden and the water ſnail. In the former, the mouth is placed croſswiſe, as in quadrupedes; furniſhed with jaw-bones, lips and teeth. In moſt of the ſea ſnails, the mouth is placed longitudinally in the head;

and, in ſome, obliquely, or on one ſide. Others, of the Trochus kind, have no mouth whatſoever; but are furniſhed with a trunk, very long in ſome kinds, and ſhorter in others.

Snails of the Trochus kind, furniſhed thus with an inſtrument of offence, deſerve our particular attention. The trunk of the Trochus is fleſhy, muſcular, ſupple, and hollow. Its extremity is bordered with a cartilage, and toothed like a ſaw. The ſnails that are provided with this, may be conſidered as the predacious tribe, among their fellows of the bottom. They are, among ſnails, what the tiger, the eagle or the ſhark is among beaſts, birds or fiſhes. The whole race of ſhelled animals avoid their approach; for their habitations, however powerfully and ſtrongly built, though never ſo well fortified, yield to the ſuperior force of theſe invaders. Though provided with a thick clumſy ſhell themſelves, yet they move with greater ſwiftneſs at the bottom than moſt other ſhell fiſh: and ſeize their prey with greater facility. No ſhell ſo large but they will boldly venture to attack; and, with their piercing augre-like trunk, will quickly bore it through. No efforts the other animal makes can avail: it expands itſelf, and riſes to the ſurface; but the enemy riſes with it: it again ſinks to the

bottom, but ſtill its deſtroyer cloſely adheres. In this manner the carnivorous ſhell-fiſh, as ſome naturaliſts call it, ſticks for ſeveral days, nay weeks, to its prey, until, with its trunk, it has ſucked out all ſubſtance, or until it drops off when the other begins to putrefy.

Thus it would ſeem throughout nature, that no animal is ſo well defended, but that others are found capable of breaking in upon its entrenchments. The garden ſnail ſeems tolerably well guarded; but the wall of its ſhell is paper itſelf, in compariſon with that which fortifies ſome of the ſea ſnail kind. Beſide this thick ſhell, many of them are alſo furniſhed with a lid, which covers the mouth of the ſhell, and which opens and ſhuts at the animal's pleaſure. When the creature hunts for food, it opens its box, gropes or ſwims about; and, when ſatisfied, drops its lid and ſinks to the bottom: there it might be ſuppoſed to remain in perfect ſecurity; but the trochus ſoon finds the way to break into the thickeſt part of its encloſure, and quickly deſtroys it with the moſt fatal induſtry.

The being liable to the attacks of the trochus ſeems to be a calamity to which moſt of this tribe are ſubject. Scarce a ſhell is met with entire and found to the end of its convolutions; but particularly the thinneſt ſhells are the moſt

ſubject to be thus invaded. As their ſhells are eaſily pierced, the predatory ſhell-fiſh, or the ſea-worm, chiefly ſeek them for ſubſiſtence; and of thoſe thin paper-like ſhells, not one in an hundred is found that has not ſuffered ſome diſaſter. As they are lighter than other ſhell-fiſh, they ſwim with greater eaſe; and this is the chief method of avoiding their heavier thick-ſhelled purſuers. The food of all ſnails properly lies at the bottom; when, therefore, the nautilus, or other thin ſhelled fiſh, are ſeen buſily ſwimming at the ſurface, it may be, that, inſtead of ſporting or ſunning themſelves, as ſome are apt to ſuppoſe, they are actually labouring to eſcape their moſt deadly purſuers.

Of all ſea ſnails, that which is moſt frequently ſeen ſwimming upon the ſurface, and whoſe ſhell is the thinneſt and moſt eaſily pierced, is the Nautilus. Whether, upon theſe occaſions, it is employed in eſcaping its numerous enemies at the bottom, or ſeeking for food at the ſurface, I will not venture to decide. It ſeems moſt probable, that the former is the cauſe of its frequently appearing; for, upon opening the ſtomach, it is found to contain chiefly that food which it finds at the bottom. This animal's induſtry, therefore, may be owing to its

fears; and all those arts of sailing, which it has taught mankind, may have been originally the product of necessity. But the nautilus is too famous not to demand a more ample description.

Although there be several species of the nautilus, yet they all may be divided into two: the one with a white shell, as thin as paper, which it often is seen to quit, and again to resume; the other with a thicker shell, sometimes of a beautiful mother-of-pearl colour, and that quits its shell but rarely. This shell outwardly resembles that of a large snail, but is generally six or eight inches across: within, it is divided into forty partitions, that communicate with each other by doors, if I may so call them, through which one could not thrust a goose-quill: almost the whole internal part of the shell is filled by the animal; the body of which, like its habitation, is divided into as many parts as there are chambers in its shell: all the parts of its body communicate with each other, through the doors or openings, by a long blood-vessel, which runs from the head to the tail: thus the body of the animal, if taken out of the shell, may be likened to a number of soft bits of flesh, of which there are forty, threaded upon a string. From this extraordinary conformation, one would not be apt to suppose

that the nautilus ſometimes quitted its ſhell, and returned to it again; yet nothing, though ſeemingly more impoſſible, is more certain. The manner by which it contrives to diſengage every part of its body from ſo incricate an habition; by which it makes a ſubſtance, to appearance as thick at one's wriſt, paſs through forty doors, each of which would ſcarcely admit a gooſe quill, is not yet diſcovered: but the fact is certain; for the animal is often found without it ſhell; and the ſhell more frequently deſtitute of the animal. It is moſt probable, that it has a power of making the ſubſtance of one ſection of its body remove up into that which is next; and thus, by multiplied removals, it gets free.

But this, though very ſtrange, is not the peculiarity for which the nautilus has been the moſt diſtinguiſhed. Its ſpreading the thin oar, and catching the flying gale, to uſe the poet's deſcription of it, has chiefly excited human curioſity. Theſe animal, particularly thoſe of the white, light kind, are chiefly found in the Mediterranean; and ſcarce any who have ſailed on that ſea, but muſt often have ſeen them. When the ſea is calm, they are obſerved floating on the ſurface; ſome ſpreading their little ſail;

ſome rowing with their feet, as if for life and death; and others ſtill, floating upon their mouths, like a ſhip with the keel upward. If taken while thus employed, and examined, the extraordinary mechaniſm of their limbs for ſailing will appear more manifeſt. The nautilus is furniſhed with eight feet, which iſſue near the mouth, and may as properly be called barbs: theſe are connected to each other by a thin ſkin, like that between the toes of a duck, but much thinner and more tranſparent. Of theſe eight feet thus connected, ſix are ſhort, and theſe are held up as ſails to catch the wind in ſailing: the two others are longer, and are kept in the water; ſerving, like paddles, to ſteer their courſe by. When the weather is quite calm, and the animal is purſued from below, it is then ſeen expanding only a part of its ſails, and rowing with the reſt: whenever it is interrupted, or fears danger from above, it inſtantly furls the ſail, catches in all its oars, turns its ſhell mouth downward, and inſtantly ſinks to the bottom. Sometimes alſo it is ſeen pumping the water from its leaking hulk; and, when unfit for ſailing deſerts its ſhell entirely. The forſaken hulk is ſeen floating along, till it daſhes, by a kind of ſhipwreck, upon the rocks or the ſhore,

From the above deſcription, I think we may conſider this animal rather as attempting to ſave itſelf from the attacks of its deſtroyers, than as rowing in purſuit of food. Certain it is, that no creature of the deep has more numerous and more powerful enemies. Its ſhell is ſcarcely ever found in perfect preſervation; but is generally ſeen to bear ſome marks of hoſtile invaſion. Its little arts, therefore, upon the ſurface of the water, may have been given it for protection; and it may be thus endued with comparative ſwiftneſs, to avoid the crab, the ſea-ſcorpion, the trochus, and all the ſlower predacious reptiles that lurk for it at the bottom of the water.

From this general view of ſnails, they appear to be a much more active, animated tribe, than from their figure one would at firſt conceive. They ſeem, to an inattentive ſpectator, as mere inert maſſes of ſoft fleſh, rather loaded than covered with a ſhell, ſcarcely capable of motion, and inſenſible to all the objects around them. When viewed more cloſely, they are found to be furniſhed with the organs of life and ſenſation in tolerable perfection: they are defended with armour, that is at once both light and ſtrong; they are as active as their neceſſities

require; and are poſſeſſed of appetites more poignant than thoſe of animals that ſeem much more perfectly formed. In ſhort, they are a fruitful induſtrious tribe; furniſhed, like all other animals, with the powers of eſcape and invaſion; they have their purſuits and their enmities; and, of all creatures of the deep, they have moſt to fear from each other.

CHAP.

CHAP. III.

Of Bivalved Shell-Fiſh, or Shells of the Oyſter Kind.

IT may ſeem whimſical to make a diſtinction between the animal perfections of turbinated and bivalved ſhell-fiſh, or to grant a degree of ſuperiority to the ſnail above the oyſter. Yet this diſtinction ſtrongly and apparently obtains in nature; and we ſhall find the bivalved tribe of animals in every reſpect inferior to thoſe we have been deſcribing. Inferior in all their ſenſations; inferior in their powers of motion; but particularly inferior in their ſyſtem of animal generation. The ſnail tribe, as we ſaw, are hermaphrodite, but require the aſſiſtance of each other for fecundation; all the bivalve tribe are hermaphrodite in like manner, but they require no aſſiſtance from each other towards impregnation; and a ſingle muſcle or oyſter, if there were no other in the world, would quickly repleniſh the ocean. As the land ſnail from its being beſt known took the lead in the former claſs, ſo the freſh-water muſcle, for the ſame reaſon, may take lead in this. The life and manners of ſuch as belong to the ſea will be beſt diſplayed in the compariſon.

The muſcle, as is well known, whether belonging to freſh or ſalt-water, conſiſts of two equal ſhells, joined at the back by a ſtrong muſcular ligament that anſwers all the purpoſes of an hinge. By the elaſtic contraction of theſe, the animal can open its ſhells at pleaſure, about a quarter of an inch from each other. The fiſh is fixed to either ſhell by four tendons, by means of which it ſhuts them cloſe, and keeps its body firm from being cruſhed by any ſhock againſt the walls of its own habitation. It is furniſhed, like all other animals of this kind, with vital organs, though theſe are ſituated in a very extraordinary manner. It has a mouth furniſhed with two fleſhy lips; its inteſtine begins at the bottom of the mouth, paſſes through the brain, and makes a number of circumvolutions through the liver; on leaving this organ, it goes on ſtraight into the heart, which it penetrates, and ends in the anus; near which the lungs are placed, and through which it breathes, like thoſe of the ſnail kind; and in this manner its languid circulation is carried on *.

But the organs of generation are what moſt deſerve to excite our curioſity. Theſe conſiſt in each muſcle of two ovaries, which are the female part of its furniture, and of two ſeminal

* M. Mery. Anat. des Moules d'Etang.

veſſels reſembling what are found in the male. Each ovary and each ſeminal veſſel has its own proper canal; by the ovary canal the eggs deſcend to the anus; and there alſo the ſeminal canals ſend their fluids to impregnate them. By this contrivance, one ſingle animal ſuffices for the double purpoſes of generation; and the eggs are excluded and impregnated by itſelf alone.

As the muſcle is thus furniſhed with a kind of ſelf-creating power, there are few places where it breeds that it is not found in great abundance. The ovaries uſually empty themſelves of their eggs in ſpring, and they are repleniſhed in autumn. For this reaſon they are found empty in ſummer and full in winter. They produce in great numbers, as all bivalved ſhell-fiſh are found to do. The fecundity of the ſnail kind is trifling in compariſon to the fertility of theſe. Indeed it may be aſſerted as a general rule in nature, that the more helpleſs and contemptible the animal, the more prolific it is always found. Thus all creatures that are incapable of reſiſting their deſtroyers, have nothing but their quick multiplication, for the continuation of their exiſtence.

The multitude of theſe animals in ſome places is very great; but from their defenceleſs ſtate,

the number of their deſtroyers are in equal proportion. The crab, the cray-fiſh, and many other animals, are ſeen to devour them; but the trochus is their moſt formidable enemy. When their ſhells are found deſerted, if we then obſerve cloſely, it is moſt probable we ſhall find that the trochus has been at work in piercing them. There is ſcarce one of them without a hole in it; and this probably was the avenue by which the enemy entered to deſtroy the inhabitant.

But notwithſtanding the number of this creature's animated enemies, it ſeems ſtill more fearful of the agitations of the element in which it reſides; for if daſhed againſt rocks, or thrown far on the beach, it is deſtroyed without a power of redreſs. In order to guard againſt theſe, which are to this animal the commoneſt and the moſt fatal accidents, although it has a power of ſlow motion, which I ſhall preſently deſcribe, yet it endeavours to become ſtationary, and to attach itſelf to any fixed object it happens to be near. For this purpoſe it is furniſhed with a very ſingular capacity of binding itſelf by a number of threads to whatever object it approaches; and theſe Reaumur ſuppoſed it ſpun artificially, as ſpiders their webs which they faſten againſt a wall. Of this however, later

philoſophers have found very great reaſon to doubt. It is therefore ſuppoſed that theſe threads, which are uſually called the beard of the muſcle, are the natural growth of the animal's body, and by no means produced at pleaſure. Indeed, the extreme length of this beard in ſome, which far exceeds the length of the body ſeems impoſſible to be manufactured by the thruſting out and drawing in of the tongue, with the glutinous matter of which the French philoſopher ſuppoſed thoſe threads were formed. It is even found to encreaſe with the growth of the animal; and as the muſcle becomes larger and older, the beard becomes longer and its filaments more ſtrong*. Be this as it will, nothing is more certain than that the muſcle is found attached by theſe threads to every fixed object; ſometimes, indeed, for want of ſuch an object, theſe animals are found united to each other; and though thrown into a lake ſeparately, they are taken out in bunches of many together.

To have ſome fixed reſting place where the muſcle can continue, and take in its accidental food, ſeems the ſtate that this animal chiefly deſires. Its inſtrument of motion, by which

* Mercier du Paty, ſur le bouchots à moules. Tom. ii. de l' Academie de la Rochelle.

it contrives to reach the object it wants to bind itſelf to, is that muſcular ſubſtance reſembling a tongue, which is found long in proportion to the ſize of the muſcle. In ſome it is two inches long, in others not a third part of theſe dimenſions. This the animal has a power of thruſting out of its ſhell; and with this it is capable of making a ſlight furrow in the ſand at the bottom. By means of this furrow it can erect itſelf upon the edge of its ſhell; and thus continuing to make the furrow in proportion as it goes forward, it reaches out its tongue, that anſwers the purpoſe of an arm, and thus carries its ſhell edge-ways, as in a groove, until it reach the point intended. There where it determines to take up its reſidence it fixes the ends of its beard, which are glutinous, to the rock or the object, whatever it be; and thus, like a ſhip at anchor, braves all the agitations of the water. Sometimes the animal is attached by a large number of threads; ſometimes but by three or four, that ſeem ſcarce able to retain it. When the muſcle is fixed in this manner, it lives upon the little earthy particles that the water tranſports to its ſhells, and perhaps the fleſh of the moſt diminutive animals. However, it does not fail to grow conſiderably; and ſome of this kind have been found a foot long. I have ſeen

the beards a foot and an half; and of this ſubſtate the natives of Palermo ſometimes make gloves and ſtockings.

Theſe ſhell-fiſh are found in lakes, rivers, and in the ſea. Thoſe of the lake often grow to a very large ſize; but they ſeem a ſolitary animal, and are found generally ſeparate from each other. Thoſe of rivers or not ſo large, but yet in greater abundance; but the ſea muſcle of all others is perhaps the moſt plenty. Theſe are often bred artificially in ſalt-water marſhes that are overflowed by the tide; the fiſhermen throwing them in at the proper ſeaſons; and there being undiſturbed by the agitations of the ſea, and not preyed upon by their powerful enemies at the bottom, they caſt their eggs, which ſoon become perfect animals, and theſe are generally found in cluſters of ſeveral dozen together. It requires a year for the peopling a muſcle-bed; ſo that, if the number conſiſts of forty thouſand, a tenth part may annually be left for the peopling the bed anew. Muſcles are taken from their beds from the month of July to October; and they are ſold at a very moderate price.

From this animal the oyſter differs very little, except in the thickneſs of its ſhell, and its greater imbecility. The oyſter, like the muſcle,

is formed with organs of life and refpiration, with inteftines which are very voluminous, a liver, lungs, and heart. Like the mufcle, it is felf-impregnated; and the fhell, which the animal foon acquires, ferves it for its future habitation. Like the mufcle, it opens its fhell to receive the influx of water, and like that animal is ftrongly attached to its fhells both above and below.

But it differs in may particulars. In the firft place its fhells are not equal, the one being cupped, the other flat; upon the cupped fhell it is always feen to reft; for if it lay upon the flat fide it would then lofe all its water. It differs alfo in the thicknefs of its fhells, which are fo ftrongly lined and defended, that animal will attempt to pierce them. But though the oyfter be fecured from the attacks of the fmall reptiles at the bottom, yet it often ferves as an object to which they are attached. Pipe-worms and other little animals fix their habitation to the oyfter's fides, and in this manner continue to live in fecurity. Among the number of thefe is a little red worm, that is often found upon the fhell; which fome, from never feeing oyfters copulate, erroneoufly fuppofed to be the male by which their fpawn was impregnated.

The oyfter differs alfo from the mufcle in

being

being utterly unable to change its ſituation. The muſcle, as we have obſerved, is capable of erecting itſelf on an edge, and going forward with a ſlow laborious motion. The oyſter is wholly paſſive, and endeavours by all its powers to reſt fixed to one ſpot at the bottom. It is entirely without that tongue which we ſaw anſwering the purpoſes of an arm in the other animal; but nevertheleſs is often attached very firmly to any object it happens to approach. Rocks, ſtones, pieces of timber, or ſea-weeds, all ſeem proper to give it a fixture, and to ſecure it againſt the agitation of the waves. Nothing ſo common in the rivers of the tropical climates as to ſee oyſters growing even amidſt the branches of the foreſt. Many trees which grow along the banks of the ſtream often bend their branches into the water, and particularly the mangrove, which chiefly delights in a moiſt ſituation. To theſe the oyſters hang in cluſters, like apples upon the moſt fertile tree; and in proportion as the weight of the fiſh ſinks the plant into the water, where it ſtill continues growing, the number of oyſters encreaſe, and hang upon the branches. Thus there is nothing that theſe ſhell-fiſh will not ſtick to; they are often even found to ſtick to each other. This is effected by means of a glue proper to

themſelves, which, when it cements, the joining is as hard as the ſhell, and is as difficultly broken. The joining ſubſtance, however, is not always of glue; but the animal grows to the rocks, ſomewhat like the muſcle, by threads: although theſe are only ſeen to take root in the ſhell, and not, as in the muſcle, to ſpring from the body of the fiſh itſelf.

Oyſters uſually caſt their ſpawn in May, which at firſt appear like drops of candle-greaſe, and ſtick to any hard ſubſtance they fall upon. Theſe are covered with a ſhell in two or three days; and in three years the animal is large enough to be brought to market. As they invariably remain in the places where they are laid, and as they grow without any other ſeeming food than the afflux of ſea-water, it is the cuſtom at Colcheſter, and other parts of the kingdom, where the tide ſettles in marſhes on land, to pick up great quantities of ſmall oyſters along the ſhore, which when firſt gathered ſeldom exceed the ſize of a ſixpence. Theſe are depoſited in beds where the tide comes in, and in two or three years grow to a tolerable ſize. They are ſaid to be better taſted for being thus ſheltered from the agitations of the deep; and a mixture of freſh water entering into theſe repoſitories, is ſaid to improve

their flavour, and to encreaſe their growth and fatneſs.

The oyſters, however, which are prepared in this manner, are by no means ſo large as thoſe found ſticking to rocks at the bottom of the ſea, uſually called rock-oyſters. Theſe are ſometimes found as broad as a plate, and are admired by ſome as excellent food. But what is the ſize of theſe compared to the oyſters of the Eaſt Indies, ſome of whoſe ſhells I have ſeen two feet over! The oyſters found along the coaſt of Coromandel are capable of furniſhing a plentiful meal to eight or ten men; but it ſeems univerſally agreed that they are no way comparable to ours for delicacy or flavour.

Thus the muſcle and the oyſter appear to have but few diſtinctions except in their ſhape and the power of motion in the former. Other bivalved ſhell-fiſh, ſuch as the cockle, the ſcallop, and the razor-ſhell, have differences equally minute. The power of changing place, which ſome of them effect in a manner quite peculiar to themſelves, makes their greateſt difference. The ſcallop is particularly remarkable for its method of moving forward upon land, or ſwimming upon the ſurface of the water. When this animal finds itſelf deſerted by the tide, it makes very remarkable efforts to regain the

water, moving towards the ſea in a moſt ſingular manner. It firſt gapes with its ſhell as widely as it can, the edges being often an inch aſunder; then it ſhuts them with a jerk, and by this the whole animal riſes five or ſix inches from the ground. It thus tumbles any how forward, and then renews the operation until it has attained its journey's end. When in the water it is capable of ſupporting itſelf upon the ſurface; and there opening and ſhutting its ſhells, it tumbles over and over, and makes its way with ſome celerity.

The Pivot or razor-ſhell has a very different kind of motion. As the former moves laborioſly and ſlowly forward, ſo the razor-ſhell has only a power of ſinking point downward. The ſhells of this animal reſemble nothing ſo much as the haft of a razor; and by this form it is better enabled to dive into the ſoft ſand at the bottom. All the motions of this little animal are confined to ſinking or riſing a foot downwards or upwards in the ſand, for it never leaves the ſpot where firſt it was planted. From time to time it is ſeen to riſe about half way out of its hole; but if any way diſturbed, it ſinks perpendicularly down again. Juſt over the place where the razor buries itſelf, there is a ſmall hole like a chimney, through which the animal breathes,

E. Marin sc.

1. The Bull Frog. V. 7. p. 107.

2. The Pipal. V. 7. p. 108.

or imbibes the ſea-water. Upon the deſertion of the tide, theſe holes are eaſily diſtinguiſhed by the fiſhermen who ſeek for it; and their method of enticing the razor up from the depth of its retreat is by ſprinkling a little ſea-ſalt upon the hole. This melting, no ſooner reaches the razor below than it riſes inſtantly ſtraight upwards, and ſhews about half its length above the ſurface. This appearance however is inſtantaneous; and if the fiſher does not ſeize the opportunity, the razor buries itſelf with great eaſe to its former depth. There it continues ſecure; no ſalt can allure it a ſecond time; but it remains unmoleſted, unleſs the fiſher will be at the trouble of digging it out ſometimes two feet below the ſurface.

Such are the minute differences between bivalved ſhell-fiſh; but in the great out-lines of their nature they exactly reſemble each other. It is particularly in this claſs of ſhell-fiſh that pearls are found in greateſt abundance; and it is in the internal parts of thoſe ſhells that are of a ſhining ſilvery colour that theſe gems are uſually generated; but the pearl is alſo found to breed as well in the muſcle or the ſcallop as in the oyſter. In fact it is found in all bivalved ſhells, the inſides of which reſemble that well-known ſubſtance called mother of pearl.

Whether pearls be a diseafe or an accident in the animal is fcarce worth enquiry. The common opinion is, that they are a kind of calculous concretion in the body of the animal, fomewhat refembling a ftone in the bladder, and are confequently to be confidered as a diforder. It is faid, in confirmation of this opinion, that thofe coafts upon which pearls are fifhed are very unhealthy; and therefore moft probably oyfters fhare the general influence of the climate; it is alfo added that thofe oyfters in which pearls are found are always ill-tafted, which is a fign of their being unfound; and laftly, it is afferted that the pearl grows fometimes fo big as to keep the fhells of the animal from fhutting, and that thus it dies by being expofed. It is eafy to fee the weaknefs of thefe affertions, which feem neither true nor amufing. To anfwer them in their own way, if a ftone in the bladder be a diforder, a ftone in the ftomach of an oftrich is a benefit, and fo it may be in the fhell of an oyfter. If the fhores where the pearls are fifhed be unwholfefome to man, that, inftead of being difadvantageous, is fo much the more lucky for the oyfter. If the pearl oyfters are the worft tafted, fo are kites and ravens among birds; and yet we know that they are healthy and long-lived animals: if the oyfter had ever

its ſhell kept aſunder by the pearl within it, that would be a diſeaſe indeed: but this in reality never happens; for the oyſter that breeds a large pearl always breeds a large ſhell, and the ſhell itſelf indents to receive its impreſſion. The pearl upon the whole ſeems bred from no diſorder in the animal, but accidentally produced by the ſame matter that goes to form the ſhell. This ſubſtance, which is ſoft at firſt, quickly hardens; and thus, by ſucceſſive coats, layer over layer, the pearl acquires its dimenſions. If cut through, it will be found to conſiſt of ſeveral coats, like an onion; and ſometimes a ſmall ſpeck is ſeen in the middle, upon which the coats were originally formed.

All oyſters, and moſt ſhell-fiſh, are found to contain pearls; but that which particularly obtains the name of the pearl oyſter, has a large ſtrong whitiſh ſhell, wrinkled and rough without, and within ſmooth and of a ſilver colour. From theſe the mother-of-pearl is taken, which is nothing more than the internal coats of the ſhell, reſembling the pearl in colour and conſiſtence. This is taken out and ſhaped into the variety of utenſils which are found ſo beautiful; but the pearl itſelf is chiefly prized; being found but in few oyſters, and generally adhering, ſometimes making a print in the body

of the ſhell, ſometimes at large within the ſubſtance of the fiſh.

There are a great number of pearl fiſheries in America and Aſia; but as pearls bear a worſe price than formerly, thoſe of America are in a great meaſure diſcontinued. The moſt famous of all the Aſiatic fiſheries is in the Perſian Gulph, near the Iſle of Bahren. There is another between the coaſt of Madura and the Iſland of Ceylon; and there was a third on the coaſts of Japan: but as theſe noble iſlanders have a contempt for jewels, and an abhorrence for ſuch Europeans as come in purſuit of them, that fiſhery which is thought to be the moſt valuable of all others is diſcontinued. The diving buſineſs is now carried on only in thoſe countries where the wretchedneſs of one part of mankind goes to ſupport the magnificence of the other.

The chief fiſhery, as was ſaid, is carried on in the Perſian Gulph, and the moſt valuable pearls are brought from thence. The value of theſe jewels encreaſes not only in proportion to their ſize, but alſo their figure and colour; for ſome pearls are white, others are yellowiſh, others of a lead colour; and ſome affirm they have been found as black as jet. What it is that gives theſe different tinctures to pearls is not known; Taverner aſcribes it to their lying

two or three weeks upon ſhore after the oyſter is taken; Reaumur thinks it proceeds from the colour of that part of the fiſh's body upon which the pearl lies. It is moſt probable that this colour proceeds, like the ſpots frequently found on the internal ſurface of the ſhell itſelf, from ſome accident while the pearl is growing.

The beſt coloured pearls and the roundeſt are brought from the Eaſt; thoſe of America are neither ſo white nor ſo exactly oval. All pearls however in time become yellow; they may be conſidered as an animal ſubſtance converted into a ſtony hardneſs, and like ivory taking a tincture from the air. They have been even found to decay when kept in damp or vaulted places, and to moulder into a ſubſtance ſcarce harder than chalk. When the daughters of Stilicon, that were both betrothed, one after the other, to the emperor Honorius, were buried, much of their finery was alſo depoſited with them in the ſame tomb. In this manner they remained buried for above eleven hundred years, till the foundations of the church of St. Peter were laying. Their tomb was then diſcovered, and all their finery was found in tolerable preſervation except their pearls, which were converted by time and damps into a chalky powder.

The wretched people that are deſtined to fiſh for pearls, are either Negroes or ſome of the pooreſt of the natives of Perſia. The inhabitants of this country are divided into tyrants and ſlaves. The divers are not only ſubject to the dangers of the deep, to tempeſts, to ſuffocation at the bottom, to being devoured by ſharks, but from their profeſſion univerſally labour under a ſpitting of blood, occaſioned by the preſſure of air upon their lungs in going down to the bottom. The moſt robuſt and healthy young men are choſen for this employment, but they ſeldom ſurvive it above five or ſix years. Their fibres become rigid; their eye-balls turn red; and they uſually die conſumptive.

It is amazing how very long they are ſeen to continue at the bottom. Some, as we are aſſured, have been known to continue three quarters of an hour under water without breathing; and to one unuſed to diving, ten minutes would ſuffocate the ſtrongeſt. Whether from ſome effort the blood burſts the old paſſage which it had in the fœtus, and circulates without going through the lungs, it is not eaſy to tell; but certain it is that ſome bodies have been diſſected with this canal of communication open, and theſe extraordinary divers may be internally formed in that manner.

Be this as it may, no way of life ſeems ſo laborious, ſo dangerous, or ſo painful. They fiſh for pearls, or rather the oyſters that contain them, in boats twenty-eight feet long; and of theſe there are ſometimes three or four hundred at a time, with each ſeven or eight ſtones, which ſerve for anchors. There are from five to eight divers belonging to each, that dive one after another. They are quite naked, except that they have a net hanging down from the neck to put their oyſters in, and gloves on their hands to defend them while they pick the oyſters from the holes in the rocks; for in this manner alone can they be gathered. Every diver is ſunk by means of a ſtone, weighing fifty pounds, tied to the rope by which he deſcends. He places his foot in a kind of ſtirrup, and laying hold of the rope with his left-hand, with his right he ſtops his noſe to keep in his breath, as upon going down he takes in a very long inſpiration. They are no ſooner come to the bottom, but they give the ſignal to thoſe who are in the boat to draw up the ſtone; which done, they go to work, filling their net as faſt as they can; and then giving another ſignal, the boats above pull up the net loaded with oyſters, and ſhortly after the diver himſelf to take a new inſpiration. They dive

to the depth of fifteen fathoms, and feldom go deeper. They generally go every morning by break of day to this fatiguing employment, taking the land-wind to waft them out to fea, and returning with the fea-breeze at night. The owners of the boats ufually hire the divers, and the reft of the boats crew, as we do our labourers, at fo much a day. All the oyfters are brought on fhore, where they are laid in a great heap till the pearl fifhery is over, which continues during the months of November and December. When opportunity ferves, they then examine every oyfter, and it is accidental whether the capture turns out advantageous. Indeed no human being can wifh well to a commerce, which thus chains fuch a number of fellow-creatures to the bottom, to pluck up a glittering mouldering pebble.

CHAP.

Elias Martin sc.

Sea Urchins.

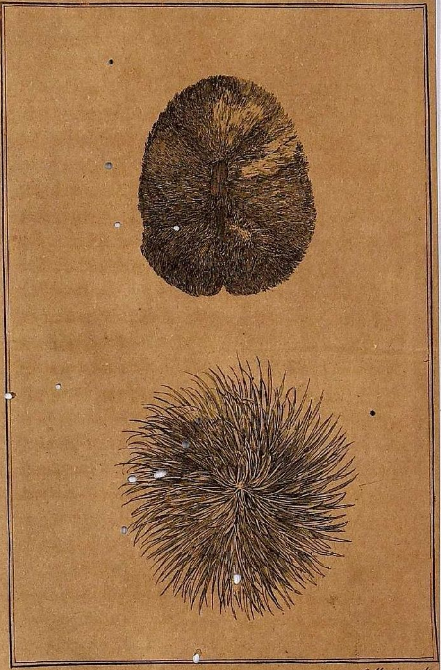
CHAP. IV.

Of Multivalve Shell-fiſh.

MULTIVALVE SHELL-FISH may be conſidered as animals ſhut up in round boxes. To view their habitations externally, one would be little apt to conſider them as the retreats of living creatures; and ſtill leſs, to ſuppoſe that ſome of them carry their boxes with a tolerable ſhare of ſwiftneſs, ſo as to eſcape their purſuers. Of theſe there are principally two kinds; ſuch as move, and ſuch as are ſtationary: the firſt are uſually known in our cabinets by the name of ſea-eggs; the others are as often admired, from the cavities which they ſcoop out for their habitation in the hardeſt marble. The firſt are called, by naturaliſts, Echini, or Urchins: the latter are called Pholades, or File Fiſh. Of both there are ſeveral ſorts; but, by deſcribing theſe two, we ſhall have a competent idea of all the reſt.

To a ſlight view, the ſea-urchin may be compared to the huſk of a cheſtnut; being like it round, and with a number of bony prickles ſtanding out on every ſide. To exhibit this extraordinary animal in every light—if we could conceive a turnip ſtuck full of pins on every

ſide, and running upon theſe pins with ſome degree of ſwiftneſs, we ſhould have ſome idea of this extraordinary creature. The mouth is placed downwards; the vent is above; the ſhell is a hollow vaſe, reſembling a ſcooped apple; and this filled with a ſoft, muſcular ſubſtance, through which the inteſtines wind from the bottom to the top. The mouth, which is placed undermoſt, is large and red, furniſhed with five ſharp teeth, which are eaſily diſcerned. The jaws are ſtrengthened by five ſmall bones, in the centre of which is a ſmall fleſhy tongue; and from this the inteſtines make a winding of five ſpires, round the internal ſides of the ſhell, ending at top, where the excrements are excluded. But what makes the moſt extraordinary part of this animal's conformation, are its horns and its ſpines, that point from every part of the body, like the horns of a ſnail, and that ſerve at once as legs to move upon, as arms to feel with, and as inſtruments of capture and defence. Between theſe horns it has alſo ſpines that are not endued with ſuch a ſhare of motion. The ſpines and the horns iſſue from every part of its body; the ſpines being hard and prickly; the horns being ſoft, longer than the ſpines, and never ſeen except in the water. They are put forward and withdrawn like the



Sea Urchins.

C. Marin sculp.

horns of a ſnail, and are hid at the baſes of the ſpines, ſerving, as was ſaid before, for procuring food and motion. All this apparatus, however, is only ſeen when the animal is hunting its prey at the bottom of the water; for a few minutes after it is taken, all the horns are withdrawn into the body, and moſt of the ſpines drop off.

It is generally ſaid of inſects, that thoſe which have the greateſt number of legs, always move the ſloweſt: but this animal ſeems to be an exception to the rule; for though furniſhed with two thouſand ſpines, and twelve hundred horns, all ſerving for legs, and from their number ſeeming to impede each other's motion, yet it runs with ſome ſhare of ſwiftneſs at the bottom, and it is ſometimes no eaſy matter to overtake it. It is often taken upon the ebb, by following it in ſhallow water, either in an ozier baſket, or ſimply with the hand. Both the ſpines and the horns aſſiſt its motion; and the animal is uſually ſeen running with the mouth downward.

Some kinds of this animal are as good eating as the lobſter; and its eggs, which are of a deep red, are conſidered as a very great delicacy. But of others the taſte is but indifferent; and in all places, except the Mediterranean, they are little ſought for, except as objects of curioſity.

Very different in motion, though not much different in ſhape from theſe, are the Acorn Shell-fiſh, the Thumb-footed Shell-fiſh, and the Imaginary Barnacle. Theſe are fixed to one ſpot, and appear to vegetate from a ſtalk. Indeed, to an inattentive ſpectator, each actually ſeems to be a kind of fungus that grows in the deep, deſtitute of animal life as well as motion. But the enquirer will ſoon change his opinion, when he comes to obſerve this muſhroom-like figure more minutely. He will then ſee that the animal reſiding within the ſhell has not only life, but ſome degree of voraciouſneſs; that it has a cover, by which it opens and ſhuts its ſhell at pleaſure; that it has twelve long crooked arms, furniſhed with hair, which it thruſts forth for its prey; and eight ſmaller, which are generally kept in the ſhell. They are ſeen adhering to every ſubſtance that is to be met with in the ocean; rocks, roots of trees, ſhips bottoms, whales, lobſters, and even crabs; like bunches of grapes, clung to each other. It is amuſing enough to behold their operations *. They for ſome time remain motionleſs within their ſhell; but when the ſea is calm, they are ſeen opening the lid, and peeping about them. They then thruſt out their long neck, look

* Anderſon's Hiſtory of Greenland.

round

round them for ſome time, and then abruptly retreat back into their box, ſhut their lid, and lurk in darkneſs and ſecurity. Some people eat them; but they are in no great repute at the tables of the luxurious, where their deformed figure would be no objection to their being introduced."

Of all animals of the ſhelly tribe, the Pholades are the moſt wonderful. From their great powers of penetration, compared with their apparent imbecility, they juſtly excite the aſtoniſhment of the curious obſerver. Theſe animals are found in different places; ſometimes cloathed in their proper ſhell, at the bottom of the water; ſometimes concealed in lumps of marly earth; and ſometimes lodged, ſhell and all, in the body of the hardeſt marble. In their proper ſhell they aſſume different figures; but, in general, they ſomewhat reſemble a muſcle, except that their ſhell is found actually compoſed of five or more pieces, the ſmaller valves ſerving to cloſe up the openings left by the irregular meeting of the two principal ſhells. But their penetration into rocks, and their reſidence there, makes up the moſt wonderful part of their hiſtory.

This animal, when diveſted of its ſhell, reſembles a roundiſh, ſoft pudding, with no in-

ftrument that feems in the leaft fitted for boring into ftones, or even penetrating the fofteft fubftances. It is furnifhed with two teeth indeed; but thefe are placed in fuch a fituation as to be incapable of touching the hollow furface of its ftony dwelling: it has alfo two covers to its fhell, that open and fhut at either end; but thefe are totally unferviceable to it as a miner. The inftrument with which it performs all its operations, and buries itfelf in the hardeft rocks, is only a broad flefhy fubftance, fomewhat refembling a tongue, that is feen iffuing from the bottom of its fhell. With this foft, yielding inftrument, it perforates the moft folid marbles; and having, while yet little and young, made its way, by a very narrow entrance, into the fubftance of the ftone, it then begins to grow bigger, and thus to enlarge its apartment.

The feeming unfitnefs, however, of this animal for penetrating into rocks, and there forming an habitation, has induced many philofophers to fuppofe that they entered the rock while it was yet in a foft ftate, and from the petrifying quality of the water, that the whole rock afterwards hardened round them by degrees. Thus any penetrating quality, it was thought, was unjuftly afcribed to them, as they

only bored into a soft substance, that was hardened by time. This opinion, however, has been confuted, in a very satisfactory manner, by Doctor Bohads, who observed, that many of the pillars of the temple of Serapis at Puteoli were penetrated by these animals. From thence he very justly concludes, that the pholas must have pierced into them since they were erected; for no workmen would have laboured a pillar into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt but that the pillars were perfectly sound when erected; and that the pholades have attacked them, during that time in which they continued buried under water, by means of the earthquake that swallowed up the city *.

From hence it appears that, in all nature, there is not a greater instance of perseverance and patience than what this animal is seen to exhibit. Furnished with the bluntest and softest augre, by slow, successive applications, it effects what other animals are incapable of performing by force; penetrating the hardest bodies only with its tongue. When, while yet naked and very small, it has effected an entrance, and has buried its

* Bohadsch de Animalibus Marinis, p. 153.

body in the ſtone, it there continues for life at its eaſe; the ſea-water that enters at the little aperture ſupplying it with luxurious plenty. When the animal has taken too great a quantity of water, it is ſeen to ſpurt it out of its hole with ſome violence. Upon this ſeemingly thin diet, it quickly grows larger, and ſoon finds itſelf under a neceſſity of enlarging its habitation and its ſhell. The motion of the pholas is ſlow beyond conception; its progreſs keeps pace with the growth of its body; and, in proportion as it becomes larger, it makes its way farther into the rock. When it has got a certain way in, it then turns from its former direction, and hollows downward; till, at laſt, when its habitation is completed, the whole apartment reſembles the bole of a tobacco-pipe; the hole in the ſhank being that by which the animal entered.

Thus immured, the pholas lives in darkneſs, indolence, and plenty; it never removes from the narrow manſion into which it has penetrated; and ſeems perfectly content with being incloſed in its own ſepulchre. The influx of the ſea-water, that enters by its little gallery, ſatisfies all its wants; and, without any other food, it is found to grow from ſeven to eight inches long, and thick in proportion.

But they are not ſupplied only with their rocky habitation; they have alſo a ſhell to protect them: this ſhell grows upon them in the body of the rock, and ſeems a very unneceſſary addition to their defence, which they have procured themſelves by art. Theſe ſhells take different forms, and are often compoſed of a different number of valves; ſometimes ſix; ſometimes but three; ſometimes the ſhell reſembles a tube with holes at either end, one for the mouth, and the other for voiding the excrements.

Yet the pholas thus ſhut up, is not ſo ſolitary an animal as it would at firſt appear; for though it is immured in its hole without egreſs, though it is impoſſible for the animal, grown to a great ſize, to get out by the way it made in, yet many of this kind often meet in the heart of the rock, and, like miners in a ſiege, who ſometimes croſs each other's galleries, they frequently break in upon each other's retreats. Whether their thus meeting be the work of accident, or of choice, few can take upon them to determine; certain it is, they are moſt commonly found in numbers in the ſame rock; and ſometimes above twenty are diſcovered within a few inches of each other.

As to the reſt, this animal is found in greateſt numbers at Ancona, in Italy; it is found along the ſhores of Normandy and Poitou, in France; it is found alſo upon ſome of the coaſts of Scotland: and, in general, is conſidered as a very great delicacy, at the tables of the luxurious.

OF

Frogs, Lizards, and Serpents.

CHAP. I.

Of Frogs and Toads in general.

If we emerge from the deep, the firſt and moſt obvious claſs of amphibious animals that occur upon land are frogs and toads. Theſe, wherever they reſide, ſeem equally adapted for living upon land and in the water, having their hearts formed in ſuch a manner as to diſpenſe with the aſſiſtance of the lungs in carrying on the circulation. The frog and the toad therefore can live ſeveral days under water, without any danger of ſuffocation; they want but little air at the bottom; and, what is wanting, is ſupplied by lungs, like bladders, which are generally diſtended with wind, and anſwer all the purpoſes of a reſervoir from whence to breathe.

To deſcribe the form of animals ſo well known would be ſuperfluous; to mark thoſe differences that diſtinguiſh them from each other may be neceſſary. The frog moves by leaping; the toad crawls along the ground: the frog is in general leſs than the toad; its colour is brighter, and with a more poliſhed ſurface: the toad is brown, rough, and duſty. The frog is light and active, and its belly com-

paratively ſmall; the toad is ſlow, ſwolen, and incapable of eſcaping. The frog, when taken, contracts itſelf ſo as to have a lump on its back; the toad's back is ſtraight and even. Their internal parts are nearly the ſame, except that the lungs of the toad are more compact than thoſe of the frog: they have fewer air-bladders, and of conſequence the animal is leſs fitted for living under water. Such are the differences with reſpect to figure and conformation; their habitudes and manners exhibit a greater variety, and require a ſeparate deſcription.

CHAP.

CHAP. II.

Of the Frog and its Varieties.

THE external figure of the Frog is too well known to need a deſcription. Its power of taking large leaps is remarkably great, compared to the bulk of its body. It is the beſt ſwimmer of all four-footed animals; and Nature hath finely adapted its parts for thoſe ends, the arms being light and active, the legs and thighs long, and furniſhed with very ſtrong muſcles.

If we examine this animal internally, we ſhall find that it has a very little brain for its ſize; a very wide ſwallow; a ſtomach ſeemingly ſmall, but capable of great diſtenſion. The heart in the frog, as in all other animals that are truly amphibious, has but one ventricle; ſo that the blood can circulate without the aſſiſtance of the lungs, while it keeps under water. The lungs reſemble a number of ſmall bladders joined together, like the cells of a honey-comb: they are connected to the back by muſcles, and can be diſtended or exhauſted at the animal's pleaſure. The male has two teſticuli lying near the kidnies; and the female has two ovaries, lying near the ſame place: but

neither male nor female have any of the external inſtruments of generation; the anus ſerving for that purpoſe in both. Such are the moſt ſtriking peculiarities in the anatomy of a frog; and in theſe it agrees with the toad, the lizard, and the ſerpent. They are all formed internally pretty much in the ſame manner, with ſpongy lungs, a ſimple heart, and are deſtitute of the external inſtruments that ſerve to continue the kind.

Of all thoſe who have given hiſtories of the frog, Mr. Ræſel, of Nuremberg, ſeems the moſt accurate and entertaining. His plates of this animal are well known; his aſſiduity and ſkilfulneſs in obſerving its manners are ſtill more deſerving our eſteem. Inſtead, therefore, of following any other, I will take him for my guide; and though it be out of my power to amuſe the reader with his beautiful deſigns, yet there will be ſome merit in tranſcribing his hiſtory.

The Common Brown Frog begins to couple early in the ſeaſon, and as ſoon as the ice is thawed from the ſtagnating waters. In ſome places the cold protracts their genial appetite till April; but it generally begins about the middle of March. The male is uſually of a greyiſh brown colour; the female is more inclining to yellow, ſpeckled with brown. When they

couple, the colours of both are nearly alike on the back; but as they change their ſkins almoſt every eighth day, the old one falling off in the form of mucus, the male grows yellower, and the female more brown. In the males the arms and legs are much ſtronger than in the females; and, at the time of coupling, they have, upon their thumbs, a kind of fleſhy excreſcence, which they fix firmly to the breaſt of the female. This Linnæus ſuppoſed to be the male inſtrument of generation; but, by cloſer inſpection, it is found only of ſervice in holding the female in a more ſtrict embrace. It may be cut off, and the impregnation continue unimpaired: it is ſometimes found in the oppoſite ſex; and ſome of the males are found entirely without it: however, when it is cut off, the male cannot hold the female ſo ſtrongly as before.

The ſex couple only once a year: and then continue united ſometimes for four days together. At this time they both have their bellies greatly ſwolen; that of the female being filled with eggs: the male having the ſkin of the whole body diſtended with a limpid water, which is ejected in impregnation. As ſoon as the male has leaped upon the female, he throws his fore legs round her breaſt, and cloſes them ſo firmly that it is impoſſible with the naked

hands to loofe them. The male clafps his fingers between each other, in the fame manner as people when they are praying; the thumbs prefs with their thickeft fides againft the breaft of the female; and though fhe fhould ftruggle ever fo much, nothing can induce him to let go his hold. The grafp feems involuntary and convulfive; they cannot be eafily torn afunder; and they fwim, creep, and live united for fome days fucceffively, till the female has fhed her fpawn, which at length fhe does almoft in an inftant. But how the impregnation is perform-ed, without any apparent inftruments of gene-ration, has long been an object of enquiry; and ftill continues in great obfcurity. To invefti-gate the difficulty as carefully as poffible, our German philofopher continued to examine their mutal congrefs for three years together, and availed himfelf of all the lights that the knife, or analogy, could furnifh.

After having chofen twelve couple of fogs that were thus joined to each other, and having placed each couple in a glafs veffel with water, he fcarce let them out of his fight day or night, and even fate up two nights together to examine their operations. The firft day he obferved no-thing that deferved remark; but the fecond they began to be agitated more than before; the males made a noife fomewhat refembling the

grunting of a hog; the females only kept ſinking and riſing in the water.

The male of the firſt couple ejected the humidity with which his body was ſwolen, by which the water in the glaſs was made muddy; and he ſoon after quitted the female. Our philoſopher continued for twelve hours to obſerve whether the female would caſt her ſpawn; but finding her tardy, he diſſected both her and the male: in the latter, the ſpermatic veſſels were quite empty, as might naturally have been ſuppoſed; but for the female, her ſpawn ſtill remained in her body. Upon its being extracted, and put into water, it periſhed without producing any animal whatever. From hence he juſtly concluded, that it required that the eggs ſhould be ejected from the body of the female before they could be at all prolific. In another pair the male quitted the female, who did not eject her ſpawn till ſixteen days after; and theſe, like the former, came to nothing. But it was very different with ſome of the reſt. The females ejected their ſpawn, while the male ſtill remained in his ſtation, and impregnated the maſſes at different intervals as they fell from her; and theſe all brought forth animals in the uſual courſe of generation. From theſe obſervations it was eaſy to infer, that the female was impreg-

nated neither by the mouth, as ſome philoſophers imagined, nor by the excreſcence at the thumbs, as was the opinion of Linnæus, but by the inſperſion of the male ſeminal fluid upon the eggs as they proceeded from the body.

A ſingle female produces from ſix to eleven hundred eggs at a time; and, in general, ſhe throws them all out together by a ſingle effort; though ſometimes ſhe is an hour in performing this taſk. While ſhe is thus bringing forth, it may be obſerved, that the male acts the part of a midwife, and promotes the expulſion of the eggs by working with his thumbs, and compreſſing the female's body more cloſely. The eggs which were compreſſed in the womb, upon being emitted, expand themſelves into a round form, and drop to the bottom of the water, while the male ſwims off, and ſtrikes with his arms as uſual, though they had continued ſo long in a ſtate of violent contraction.

The egg, or little black globe, which produces a tadpole, is ſurrounded with two different kinds of liquor. That which immediately ſurrounds the globe is clear and tranſparent, and contained in its proper membrane; that which ſurrounds the whole is muddy and mucous. The tranſparent liquor ſerves for the nouriſhment of the tadpole from time to time; and anſwers

the

the ſame purpoſes that the white of the egg does to birds. The tadpoles, when this membrane is broken, are found to adhere with their mouth to part of it; and when they get free, they immediately ſink to the bottom of the water, never being able to get to the top after while they continue in their tadpole form.

But to return—When the ſpawn is emitted and impregnated by the male, it drops, as was ſaid, to the bottom, and there the white quickly and ſenſibly encreaſes. The eggs, which during the four firſt hours ſuffer no perceptible change, begin then to enlarge and grow lighter; by which means they mount to the ſurface of the water. At the end of eight hours, the white in which they ſwim grows thicker, the eggs loſe their blackneſs, and as they encreaſe in ſize, ſomewhat of their ſpherical form. The twenty-firſt day the egg is ſeen to open a little on one ſide, and the beginning of a tail to peep out, which becomes more and more diſtinct every day. The thirty-ninth day the little animal begins to have motion; it moves at intervals its tail; and it is perceived that the liquor in which it is circumfuſed, ſerves it for nouriſhment. In two days more, ſome of theſe little creatures fall to the bottom; while others remain ſwimming in the fluid around them,

while their vivacity and motion is feen to encreafe. Thofe which fall to the bottom remain there the whole day; but having lengthened themfelves a little, for hitherto they are doubled up, they mount at intervals to the mucus which they had quitted, and are feen to feed upon it with great vivacity. The next day they acquire their tadpole form. In three days more they are perceived to have two little fringes, that ferve as fins beneath the head; and thefe in four days after affume a more perfect form. It is then alfo that they are feen to feed very greedily upon the pond-weed with which they are to be fupplied; and, leaving their former food, on this they continue to fubfift till they arrive at maturity. When they come to be ninety-two days old, two fmall feet are feen beginning to burgeon near the tail; and the head appears to be feparate from the body. The next day, the legs are confiderably enlarged; four days after they refufe all vegetable food; their mouth appears furnifhed with teeth; and their hinder legs are completely formed. In two days more the arms are completely produced; and now the frog is every way perfect, except that it ftill continues to carry the tail. In this odd fituation the animal, refembling at once both a frog

and a lizard, is ſeen frequently riſing to the ſurface, not to take food but to breathe. In this ſtate it continues for about ſix or eight hours; and then the tail dropping off by degrees, the animal appears in its moſt perfect form.

Thus the Frog, in leſs than a day, having changed its figure, is ſeen to change its appetites alſo. So extraordinary is this transformation, that the food it fed upon ſo greedily but a few days before, is now utterly rejected; it would even ſtarve if ſupplied with no other. As ſoon as the animal acquires its perfect ſtate, from having fed upon vegetables it becomes carnivorous, and lives entirely upon worms and inſects. But as the water cannot ſupply theſe, it is obliged to quit its native element, and ſeek for food upon land, where it lives by hunting worms and taking inſects by ſurprize. At firſt, being feeble and unable to bear the warmth of the ſun, it hides among buſhes and under ſtones; but when a ſhower comes to refreſh the earth, then the whole multitude are ſeen to quit their retreats, in order to enjoy the grateful humidity. Upon many occaſions the ground is ſeen perfectly blackened with their numbers; ſome hunting for prey, and ſome ſeeking ſecure lurking places. From the myriads

that offer on ſuch occaſions, ſome have been induced to think that theſe animals were generated in the clouds, and thus ſhowered down on the earth. But had they, like Derham, traced them to the next pool, they would have found out a better ſolution for the difficulty.

The frog lives for the moſt part out of the water; but when the cold nights begin to ſet in, it returns to it's native element, always chuſing ſtagnant waters, where it can lie without danger concealed at the bottom. In this manner it continues torpid, or with but very little motion, all the winter: like the reſt of the dormant race, it requires no food; and the circulation is ſlowly carried on without any aſſiſtance from the air.

It is at the approach of ſpring that all theſe animals are rouzed from a ſtate of ſlumber to a ſtate of enjoyments. A ſhort time after they riſe from the bottom they begin to pair, while thoſe that are as yet too young come upon land before the reſt. For this reaſon, while the old ones continue concealed in the beginning of ſpring, the ſmall ones are more frequently ſeen; the former remaining in the lake to propagate, while the latter are not yet arrived at a ſtate of maturity.

The difference of ſexes, which was mentioned above, is not perceivable in theſe animals, until

they have arrived at their fourth year; nor do they begin to propagate, till they have completed that period. By comparing their ſlow growth with their other habitudes, it would appear, that they live about twelve years; but having ſo many enemies, both by land and water, it is probable that few of them arrive at the end of their term.

Frogs live upon inſects of all kinds; but they never eat any, unleſs they have motion. They continue fixed and immovable till their prey appears; and juſt when it comes ſufficiently near, they jump forward with great agility, dart out their tongues, and ſeize it with certainty. The tongue, in this animal, as in the toad, lizard and ſerpent kinds, is extremely long, and formed in ſuch a manner that it ſwallows the point down its throat; ſo that a length of tongue is thus drawn out, like a ſword from its ſcabbard, to aſſail its prey. This tongue is furniſhed with a glutinous ſubſtance; and whatever inſect it touches, infallibly adheres, and is thus held faſt till it is drawn into the mouth.

As the frog is thus ſupplied with the power of catching its prey, it is alſo very vivacious, and able to bear hunger for a very long time. I have known one of them continue a month in ſummer without any other food than the turf

on which it was placed in a glafs veffel. We are told of a German furgeon, that kept one eight years in a glafs veffel, covered with a net. Its food was at all times but fparing; in fummer he gave it frefs grafs, which it is faid to have fed upon; and, in the winter, hay, a little moiftened: he likewife now and then put flies into the glafs, which it would follow with an open mouth, and was very expert in catching them. In winter, when the flies were difficult to be found, it ufually fell away, and grew very lean; but, in the fummer, when they were plenty, it foon grew fat again. It was kept in a warm room, and was always lively and ready to take its prey; however, in the eighth winter, when there were no flies to be found, it fell away and died. It is not certain how long it might have lived had it been fupplied with proper nourifhment; but we are certain, that a very little food is capable of fufficing its neceffities.

Nor is the frog lefs tenacious of life. It will live and jump about feveral hours after its head has been cut off. It will continue active, though all its bowels are taken out; and it can live fome days, though entirely ftripped of its fkin. This cruel trick, which is chiefly practifed among fchool-boys, of fkinning frogs, an operation which is done in an inftant, feems for fome hours

no way to abate their vigour. I am aſſured that ſome of them get a new ſkin, and recover after this painful experiment.

The croaking of frogs is well known; and from thence, in ſome countries, they are diſtinguiſhed by the ludicrous title of Dutch Nightingales. Indeed, the aquatic frogs of Holland are loud beyond what one would imagine. We could hardly conceive that an animal, not bigger that one's fiſt, ſhould be able to ſend forth a note that is heard at three mile diſtance; yet ſuch is actually the caſe *. The large water frogs have a note as loud as the bellowing of a bull; and, for this purpoſe, puff up the cheeks to a ſurpriſing magnitude. Of all frogs, however, the male only croaks; the female is ſilent, and the voice in the other ſeems to be the call to courtſhip. It is certain, that at theſe times when they couple, the loudneſs of their croaking is in ſome places very troubleſome; for then the whole lake ſeems vocal; and a thouſand diſſonant notes perfectly ſtun the neighbourhood. At other times alſo, before wet weather, their voices are in full exertion; they are then heard with unceaſing aſſiduity, ſending forth their call, and welcoming the approaches of their favourite moiſture. No weather-glaſs was ever ſo true as a frog in fore-

* Ræſel, ibid.

telling an approaching change; and, in fact, the German surgeon, mentioned above, kept his frog for that purpose. It was always heard to croak at the approach of wet weather; but was as mute as a fish, when it threatened a continuance of fair. This may probably serve to explain an opinion which some entertain, that there is a month in the year, called Paddock Moon, in which the frogs never croak: the whole seems to be no more than that, in the hot season, when the moisture is dried away, and consequently when these animals neither enjoy the quantity of health or food that at other times they are supplied with, they shew, by their silence, how much they are displeased with the weather. All very dry weather is hurtful to their health, and prevents them from getting their prey. They subsist chiefly upon worms and snails; and as drought prevents these from appearing, the frog is thus stinted in its provisions, and also wants that grateful humidity which moistens its skin, and renders it alert and active.

As frogs adhere closely to the backs of their own species, so it has been found, by repeated experience, they will also adhere to the backs of fishes. Few that have ponds, but know that these animals will stick to the backs of carp, and fix their fingers in the corner of each eye. In

this manner they are often caught together; the carp blinded and wasted away. Whether this proceeds from the desires of the frog, disappointed of its proper mate, or whether it be a natural enmity between frogs and fishes, I will not take upon me to say. A story told us by Walton, might be apt to incline us to the latter opinion.

"As Dubravius, a bishop of Bohemia, was
"walking with a friend by a large pond in that
"country, they saw a frog, when the pike lay
"very sleepily and quiet by the shore side, leap
"upon his head, and the frog having expressed
"malice or anger by his swolen cheeks and
"staring eyes, did stretch out his legs, and
"embraced the pike's head, and presently
"reached them to his eyes, tearing with them
"and his teeth those tender parts; the pike,
"irritated with anguish, moves up and down
"the water, and rubs himself against weeds,
"and whatever he thought might quit him of
"his enemy; but all in vain, for the frog did
"continue to ride triumphantly, and to bite
"and torment the pike till his strength failed,
"and then the frog sunk with the pike to the
"bottom of the water: then presently the frog
"appeared again at the top and croaked, and
"seemed to rejoice like a conqueror; after

"which he presently retired to his secret hole. "The bishop that had beheld the battle, called "his fisherman to fetch his nets, and by all "means to get the pike, that they might de-"clare what had happened. The pike was "drawn forth, and both his eyes eaten out; at "which, when they began to wonder, the fish-"erman wished them to forbear, and assured "them he was certain that pikes were often so "served."

CHAP. III.

Of the Toad and its Varieties.

IF we regard the figure of the Toad, there ſeems nothing in it that ſhould diſguſt more than that of the frog. Its form and proportions are nearly the ſame; and it chiefly differs in colour, which is blacker; and its ſlow and heavy motion, which exhibits nothing of the agility of the frog: yet ſuch is the force of habit, begun in early prejudice, that thoſe who conſider the one as an harmleſs, playful animal, turn from the other with horror and diſguſt. The frog is conſidered as a uſeful aſſiſtant, in ridding our grounds of vermin; the toad, as a ſecret enemy, that only wants an opportunity, to infect us with its venom.

The imagination, in this manner biaſſed by its terrors, paints out the toad in the moſt hideous colouring, and cloaths it in more than natural deformity. Its body is broad; its back flat; covered with a duſky, pimpled hide; the belly is large and ſwagging; the pace laboured and crawling; its retreat gloomy and filthy; and its whole appearance calculated to excite diſguſt and horror: yet upon my firſt ſeeing a

toad, none of all theſe deformities in the leaſt affected me with ſenſations of loathing: born, as I was, in a country where there are no toads, I had prepared my imagination for ſome dreadful object; but there ſeemed nothing to me more alarming in the ſight, than in that of a common frog; and indeed, for ſome time, I miſtook and handled the one for the other. When firſt informed of my miſtake, I very well remember my ſenſations: I wondered how I had eſcaped with ſafety, after handling and diſſecting a toad, which I had miſtaken for a frog. I then began to lay in a fund of horror againſt the whole tribe, which, though convinced they are harmleſs, I ſhall never get rid of. My firſt imaginations were too ſtrong not only for my reaſon, but for the conviction of my ſenſes.

As the toad bears a general reſemblance of figure to the frog, ſo alſo it reſembles that animal its nature and appetites. Like the frog, the toad is amphibious; like that animal, it lives upon worms and inſects, which it ſeizes by darting out it length of tongue; and in the ſame manner alſo it crawls about in moiſt weather. The male and female couple as in all the frog kind; their time of propagation being very early in the ſpring. Sometimes the females are ſeen upon land, oppreſſed by the males; but

more frequently they are coupled in the water. They continue together ſome hours, and adhere ſo faſt as to tear the very ſkin from the parts they ſtick to. In all this they entirely reſemble the frog; but the aſſiſtance which the male lends the female, in bringing forth, is a peculiarity in this ſpecies that muſt not be paſſed over in ſilence. "In "the evening of a ſummer's day, a French "gentleman, being in the king's gardens at "Paris, perceived two toads coupled together, "and he ſtopped to examine them. Two facts "equally new ſurpriſed him: the firſt was the "extreme difficulty the female had in laying "her eggs; the ſecond was the aſſiſtance lent "her by the male for this purpoſe. The eggs "of the female lie in her body, like beads on a "ſtring; and after the firſt, by great effort, "was excluded, the male caught it with his "hinder paws, and kept working it till he had "thus extracted the whole chain. In this man"ner the animal performed, in ſome meaſure, "the functions of a midwife; impregnating, "at the ſame time, every egg as it iſſued from "the body."

It is probable, however, that this difficulty in bringing forth, obtains only upon land; and that the toad, which produces its ſpawn in the

water, performs it with as much eafe as a frog. They propagate in England, exactly in the manner of frogs; and the female, inftead of retiring to dry holes, goes to the bottom of ponds, and there lies torpid all the winter, preparing to propagate in the beginning of fpring. On thefe occafions, the number of males is found greatly to furpafs that of the other fex, there being above thirty to one; and twelve or fourteen are often feen clinging to the fame female.

When, like the frog, they have undergone all the variations of their tadpole ftate, they forfake the water; and are often feen, in a moift fummer's evening, crawling up, by myriads, from fenny places, into drier fituations. There, having found out a retreat, or having dug themfelves one with their mouth and hands, they lead a patient, folitary life, feldom venturing out, except when the moifture of a fummer's evening invites them abroad. At that time the grafs is filled with fnails, and the pathways covered with worms, which make their principal food. Infects alfo of every kind they are fond of; and we have the authority of Linnæus for it, that they fometimes continue immovable, with the mouth open, at the bottom of fhrubs, where the butterflies, in fome

meaſure faſcinated, are ſeen to fly down their throats *.

In a letter from Mr. Arſcott, there are ſome curious particulars relating to this animal, which throws great light upon its hiſtory. " Concerning the toad," ſays he, " that lived ſo many years with us, and was ſo great a favourite, the greateſt curioſity was its becoming ſo remarkably tame: it had frequented ſome ſteps before our hall door ſome years before my acquaintance commenced with it, and had been admired by my father for its ſize (being the largeſt I ever met with) who conſtantly paid it a viſit every evening. I knew it myſelf above thirty years; and by conſtantly feeding it, brought it to be ſo tame, that it always came to the candle and looked up, as if expecting to be taken up and brought upon the table, where I always fed it with inſects of all ſorts. It was fondeſt of fleſh maggots, which I kept in bran; it would follow them, and when within a proper diſtance, would fix his eyes and remain motionleſs, for near a quarter of a minute, as if preparing for the ſtroke, which was an inſtantaneous throwing its tongue at a great diſtance upon

* Amænit, vol. vi. p. 201.

"the inſect, which ſtuck to the tip by a glutinous
"matter. The motion is quicker than the eye
"can follow. I cannot ſay how long my father
"had been acquainted with the toad, before I
"knew it; but when I was firſt acquainted with
"it, he uſed to mention it as the old toad I have
"known ſo many years. I can anſwer for thirty-
"ſix years. This old toad made its appearance
"as ſoon as the warm weather came; and I al-
"ways concluded it retired to ſome dry bank,
"to repoſe till ſpring. When we new layed the
"ſteps, I had two holes made in the third ſtep,
"on each with a hollow of more than a yard
"long for it; in which I imagine it ſlept, as it
"came from thence at its firſt appearance. It
"was ſeldom provoked. Neither that toad,
"nor the multitudes I have ſeen tormented
"with great cruelty, ever ſhewed the leaſt de-
"ſire of revenge, by ſpitting or emitting any
"juice from their pimples. Sometimes, upon
"taking it up, it would let out a great quantity
"of clear water, which, as I have often ſeen it
"do the ſame upon the ſteps when quite quiet,
"was certainly its urine, and no more than a
"natural evacuation. Spiders, millepedes,
"and fleſh maggots, ſeem to be this animal's
"favourite food. I imagine if a bee was to
"be put before a toad, it would certainly eat it

"to

" to its coſt *; but as bees are ſeldom ſtir-
" ring at the ſame time that toads are, they
" rarely come in their way; as they do not ap-
" pear after ſun-riſing, or before ſun-ſet. In
" the heat of the day they will come to the
" mouth of their hole, I believe for air. I once,
" from my parlour window, obſerved a large
" toad I had in the bank of a bowling-green,
" about twelve at noon, a very hot day, very
" buſy and active upon the graſs. So un-
" common an appearance made me go out to
" ſee what it was; when I found an innu-
" merable ſwarm of winged ants had dropped
" round his hole; which temptation was as ir-
" reſiſtible as a turtle would be to a luxurious
" alderman. In reſpect to its end, had it not
" been for a tame raven, I make no doubt but
" it would have been now living. This bird,
" one day ſeeing it at the mouth of its hole,
" pulled it out, and, although I reſcued it,
" pulled out one eye, and hurt it ſo, that not-
" withſtanding its living a twelve-month, it
" never enjoyed itſelf, and had a difficulty of
" taking its food, miſſing the mark for want
" of its eye. Before that accident, it had all
" the appearance of perfect health."

* Ræſel tried a frog; it ſwallowed the bee alive: its ſtomach was ſtung, and the animal vomited it up again.

To this account of the toad's inoffenſive qualities, I will add another from Valiſnieri, to ſhew that, even taken internally, the toad is no way dangerous. " In the year 1692, ſome " German ſoldiers, who had taken poſſeſſion of " the caſtle of Arceti, finding that the peaſants " of the country often amuſed themſelves in " catching frogs, and dreſſing them for the " table; reſolved to provide themſelves with a " like entertainment, and made preparations " for frog fiſhing, in the ſame manner. It " may eaſily be ſuppoſed that the Italians and " their German gueſts were not very fond of " each other; and indeed it is natural to think " that the ſoldiers gave the poor people of the " country many good reaſons for diſcontent. " They were not a little pleaſed, therefore, " when they ſaw them go to a ditch where toads " inſtead of frogs were found in abundance. " The Germans, no way diſtinguiſhing in their " ſport, caught them in great numbers; while " the peaſants kept looking on, ſilently flat- " tering themſelves with the hopes of ſpeedy " revenge. After being brought home, the " toads were dreſſed up, after the Italian " faſhion; the peaſants, quite happy at ſeeing " their tyrants devour them with ſo good an " appetite, and expecting every moment to ſee

"them drop down dead. But what was their "ſurprize to find, that the Germans continued "as well as ever, and only complained of a "ſlight excoriation of the lips, which probably "aroſe from ſome other cauſe than that of their "repaſt."

I will add another ſtory, from Solenander; who tells us, that a tradeſman of Rome and his wife had long lived together with mutual diſcontent; the man was dropſical, and the woman amorous: this ill-matched ſociety promiſed ſoon, by the very infirm ſtate of the man, to have an end; but the woman was unwilling to wait the progreſs of the diſorder; and therefore concluded that, to get rid of her huſband, nothing was left her but poiſon. For this purpoſe, ſhe choſe out a doſe that ſhe ſuppoſed would be the moſt effectual; and having calcined ſome toads, mixed their powder with his drink. The man, after taking a hearty doſe, found no conſiderable inconvenience, except that it greatly promoted urine. His wife, who conſidered this as a beginning ſymptom of the venom, reſolved not to ſtint the next doſe, but gave it in greater quantities than before. This alſo encreaſed the former ſymptom; and, in a few days, the woman had the mortification to ſee her deteſted huſband reſtored to perfect

health; and remained in utter despair of ever being a widow.

From all this it will appear with what injustice this animal has hitherto been treated. It has undergone every reproach; and mankind have been taught to consider as an enemy, a creature that destroys that insect tribe which are their real invaders. We are to treat, therefore, as fables, those accounts that represent the toad as possessed of poison to kill at a distance; of its ejecting its venom, which burns wherever it touches; of its infecting those vegetables near which it resides; of its excessive fondness for sage, which it renders poisonous by its approach: these, and an hundred others of the same kind, probably took rise from an antipathy which some have to all animals of the kind. It is an harmless, defenceless creature, torpid and unvenomous, and seeking the darkest retreats, not from the malignity of its nature, but the multitude of its enemies.

Like all of the frog kind, the toad is torpid in winter. It chuses then for a retreat either the hollow root of a tree, the cleft of a rock, or sometimes the bottom of a pond, where it is found in a state of seeming insensibility. As it is very long-lived, it is very difficult to be killed; its skin is tough, and cannot be easily

pierced; and, though covered with wounds, the animal continues to ſhew ſigns of life, and every part appears in motion. But what ſhall we ſay to its living for centuries lodged in the boſom of a rock, or caſed within the body of an oak tree, without the ſmalleſt acceſs on any ſide, either for nouriſhment or air, and yet taken out alive and perfect! Stories of this kind it would be as raſh to contradict as difficult to believe; we have the higheſt authorities bearing witneſs to their truth, and yet the whole analogy of nature ſeems to arraign them of falſehood. Bacon aſſerts that toads are found in this manner; Doctor Plot aſſerts the ſame; there is to this day a marble chimney-piece at Chatſworth with the print of the toad upon it, and a tradition of the manner in which it was found. In the Memoirs of the Academy of Sciences there is an account of a toad found alive and healthy in the heart of a very thick elm, without the ſmalleſt entrance or egreſs *. In the year 1731 there was another found near Nants, in the heart of an old oak, without the ſmalleſt iſſue to its cell; and the diſcoverer was of opinion, from the ſize of the tree, that the animal could not have been confined there leſs than eighty or a hundred years, without ſuſte-

* Vide the Year 1719.

nance and without air. To all these we can only oppose the strangeness of the facts; the necessity this animal appears under of receiving air; and its dying like all others in the air-pump, when deprived of this all-sustaining fluid. But whether these be objections to weigh against such respectable and disinterested authority, I will not pretend to determine; certain it is that, if kept in a damp place, the toad will live for several months without any food whatsoever.

To this extraordinary account, which is doubtful, I will add another not less so; which is that of toads sucking cancerous breasts, and thus extracting the venom and performing a cure. The first account we have of this is in a letter to the Bishop of Carlisle from Doctor Pitfield, who was the first person of consequence that attended the experiment. His letter is as follows.

"Your lordship must have taken notice of a "paragraph in the papers with regard to the "application of toads to a cancered breast. A "patient of mine has sent to the neighbourhood "of Hungerford, and brought down the very "woman on whom the cure was done. I have, "with all the attention I am capable of, at-"tended the operation for eighteen or twenty "days, and am surprised at the phenomenon.

"I am in no expectation of any great ſervice "from the application; the age, conſtitution, "and thoroughly cancerous condition of the "perſon, being unconquerable barriers to it. "How an ailment of that kind, abſolutely local, "in an otherwiſe ſound habit, and of a likely "age, might be relieved, I cannot ſay. But as "to the operation, thus much I can aſſert, "that there is neither pain nor nauſeouſneſs in "it. The animal is put into a linen bag all "but its head, and that is held to the part. "It has generally inſtantly laid hold of the "fouleſt part of the ſore, and ſucked with "greedineſs until it dropped off dead. It has "frequently happened that the creature has "ſwolen immediately, and from its agonies ap-"peared to be in great pain. I have weighed "them for ſeveral days together, before and "after the application, and found their encreaſe "of weight, in their different degrees, from a "drachm to near an ounce. They frequently "ſweat exceedingly, and turn quite pale; "ſometimes they diſgorge, recover, and be-"come lively again: I think the whole ſcene "is ſurpriſing, and a very remarkable piece "of natural hiſtory. From the conſtant inof-"fenſiveneſs which I have obſerved in them, I "almoſt queſtion the truth of their poiſonous

"ſpitting. Many people here expect no great "good from the application of toads to cancers; "and where the diſorder is not abſolutely local "none is to be expected. When it is ſeated "in any part not to be well come at for extir-"pation, I think it is hardly to be imagined, "but that the having it ſucked clean as often "as you pleaſe, muſt give great relief. Every "body knows that dogs licking of ſores cures "them, which is I ſuppoſe chiefly by keeping "them clean. If there is any credit to be "given to hiſtory, poiſons have been ſucked "out. *Pallentia vulnera lambit ore venena* "*trahens*, are the words of Lucan on the occa-"ſion. If the people to whom theſe words "are applied did their cure by immediately "following the injection of the poiſon, the local "confinement of another poiſon brings the caſe "to a great degree of ſimilarity. I hope I "have not tired your Lordſhip with my long "tale: as it is a true one, and in my appre-"henſion a curious piece of natural hiſtory, I "could not forbear communicating it to you. "I own I thought the ſtory in the papers to "be an invention; and when I conſidered the "inſtinctive principle in all animals of ſelf-"preſervation, I was confirmed in my diſbelief; "but what I have related I ſaw; and all theory

"must yield to fact. It is only the Rubeth, "the land toad, which has the property of "sucking: I cannot find any the least mention "of the property in any one of the old natu-"ralists. My patient can bear to have but one "applied in twenty-four hours. The woman "who was cured had them on day and night "without intermission for five weeks. Their "time of hanging at the breast has been from "one to six hours."

Other remarks made upon their method of performing this extraordinary operation are as follow. "Some toads die very soon after they "have sucked; others live about a quarter of "an hour, and some much longer. For ex-"ample, one that was applied about seven "o'clock sucked till ten, and died as soon as it "was taken from the breast: another that "immediately succeeded continued till three "o'clock, but dropped dead from the wound: "each swelled exceedingly, and of a pale colour. "They do not seem to suck greedily, and often "turn their heads away; but during the time "of their sucking, they were heard to smack "their lips like a young child *."

From this circumstantial account of the progress of this extraordinary application, one could

* British Zoology, vol. iii. p. 338.

hardly ſuppoſe that any doubt could remain of the ingenious obſerver's accuracy; and yet, from information which I have received, from authority ſtill more reſpectable, there is much reaſon as yet to ſuſpend our aſſent. A lady, who was under the care of the preſent preſident of the college of phyſicians, was induced, by her friends, to try the experiment; and as he ſaw the caſe was deſperate, and that it would quiet her mind as well as theirs, he permitted the trial. During the whole continuance of their application, ſhe could never thoroughly perceive that they ſucked her; but that did not prevent their ſwelling and dying, as in the former inſtances. Once indeed, ſhe ſaid, ſhe thought that one of them ſeemed to ſuck; but the phyſician, and thoſe who attended, could not perceive any appearance of it. Thus, after all, it is a doubt whether theſe animals die by the internal or the external application of the cancerous poiſon.

Of this animal there are ſeveral varieties; ſuch as the Water and the Land Toad, which probably differ only in the ground-colour of their ſkin. In the firſt, it is more inclining to aſh-colour, with brown ſpots; in the other, the colour is brown, approaching to black. The water toad is not ſo large as the other;

but both equally breed in that element. The ſize of the toad with us is generally from two to four inches long; but, in the fenny countries of Europe, I have ſeen them much larger; and not leſs than a common crab, when brought to table. But this is nothing to what they are found in ſome of the tropical climates, where travellers often, for the firſt time, miſtake a toad for a tortoiſe. Their uſual ſize is from ſix to ſeven inches; but there are ſome ſtill larger, and as broad as a plate. Of theſe ſome are beautifully ſtreaked and coloured; ſome ſtudded over, as if with pearls; others briſtled with horns or ſpines; ſome have the head diſtinct from the body, while others have it ſo ſunk in, that the animal appears without a head. All theſe are found in the tropical climates in great abundance, and particularly after a ſhower of rain. It is then that the ſtreets ſeem entirely paved with them; they then crawl from their retreats, and go into all places, to enjoy their favourite moiſture. With us the opinion of its raining toads and frogs, has long been juſtly exploded; but it ſtill is entertained in the tropical countries, and that not only by the ſavage natives, but the more refined ſettlers, who are apt enough to add the prejudices of other nations to their own.

It would be a tedious, as well as a uſeleſs taſk, to enter into all the minute diſcriminations of theſe animals, as found in different countries or places; but the Pipal, or the Surinam Toad, is too ſtrange a creature, not to require an exact deſcription. There is not, perhaps, in all nature, a more extraordinary phenomenon, than that of an animal breeding and hatching its young in its back; from whence, as from a kind of hot-bed, they crawl, one after the other, when come to maturity.

The pipal is in form more hideous than even the common toad, Nature ſeeming to have marked all thoſe ſtrange-mannered animals with peculiar deformity. The body is flat and broad; the head ſmall; the jaws, like thoſe of a mole, are extended, and evidently formed for rooting in the ground: the ſkin of the neck forms a ſort of wrinkled collar: the colour of the head is of a dark cheſnut, and the eyes are ſmall: the back, which is very broad, is of a lightiſh grey, and ſeems covered over with a number of ſmall eyes, which are round, and placed at nearly equal diſtances. Theſe eyes are very different from what they ſeem; they are the animal's eggs, covered with their ſhells, and placed there for hatching. Theſe eggs are buried deep in the ſkin, and in

the beginning of incubation but juſt appear; and are very viſible when the young animal is about to burſt from its confinement. They are of a reddiſh, ſhining yellow colour; and the ſpaces between them are full of ſmall warts, reſembling pearls.

This is their ſituation, previous to their coming forth: but nothing ſo much demands our admiration, as the manner of their production. The eggs, when formed in the ovary, are ſent, by ſome internal canals, which anatomiſts have not hitherto deſcribed, to lie and come to maturity under the bony ſubſtance of the back: in this ſtate they are impregnated by the male, whoſe ſeed finds its way by pores very ſingularly contrived, and pierces not only the ſkin but the perioſteum: the ſkin, however, is ſtill apparently entire, and forms a very thick covering over the whole brood; but as they advance to maturity, at different intervals, one after another, the egg ſeems to ſtart forward and burgeon from the back, becomes more yellow, and at laſt breaks; when the young one puts forth its head: it ſtill, however, keeps its ſituation, until it has acquired a proper degree of ſtrength, and then it leaves the ſhell, but ſtill continues to keep upon the back of the parent. In this manner the pipal is ſeen travelling with

her wonderous family on her back, in all the different ſtages of maturity. Some of the ſtrange progeny, not yet come to ſufficient perfection, appear quite torpid, and as yet without life in the egg: others ſeem juſt beginning to riſe through the ſkin; here peeping forth from the ſhell; and there, having entirely forſaken their priſon: ſome are ſporting at large upon the parent's back; and others deſcending to the ground, to try their own fortune below.

Such is the deſcription given us of this ſtrange production, by Seba; in which he differs from Ruyſch, who affirms, that the young ones are bred in the back of the male only, where the female lays her eggs. I have followed Seba, however; not becauſe he is better authority, but becauſe he is more poſitive of the truth of his account, and aſſerts, aſſuredly, that the eggs are found on the back of the female only. Many circumſtances, however, are wanting towards completing his information; ſuch as a deſcription of the paſſage by which the egg finds its way into the back; the manner of its fecundation; the time of geſtation; as alſo an hiſtory of the manners of this ſtrange animal itſelf: but, by a prolixity that too much prevails among naturaliſts at preſent, he leaves the moſt intereſting object of curioſity,

to give us a detailed defcription of the legs and claws of the pipal, about which we have very little concern.

The male pipal is every way larger than the female, and has the fkin lefs tightly drawn round the body. The whole body is covered with puftules, refembling pearls; and the belly, which is of a bright yellow, feems as if it were fewed up from the throat to the vent, a feam being feen to run in that direction. This animal, like the reft of the frog kind, is moft probably harmlefs; though we are told of terrible effects refulting from its powder when calcined. This, however, muft certainly be falfe: no creature whatever, when calcined, can be poifonous; for the fire burns away whatever might have been dangerous in their compofition: all animal fubftances, when calcined, being entirely the fame.

CHAP.

CHAP. IV.

Of Lizards in general.

THERE is ſcarce a naturaliſt that has treated of Lizards, but has a particular manner of ranking them, in the ſcale of animated nature. Ray, rather ſtruck with the number of their legs, than their habits and conformation, has exalted them among quadrupedes; while Linnæus, attentive only to their long ſlender forms, has degraded them among ſerpents. Briſſon gives them a diſtinct claſs by themſelves, under the name of Reptiles. Klein gives them a claſs inferior to beaſts, under the name of Naked Quadrupedes. Some, in ſhort, from their ſcaly covering, and fondneſs for the water, have given them to the fiſhes; while there have not been wanting naturaliſts who have claſſed them with inſects, as the ſmaller kinds of this claſs ſeem to demand.

It is indeed no eaſy matter to tell to what claſs in nature lizards are chiefly allied. They are unjuſtly raiſed to the rank of beaſts, as they bring forth eggs, diſpenſe with breathing, and are not covered with hair. They cannot be placed among fiſhes, as the majority of them

live

live upon land: they are excluded from the ſerpent tribe, by their feet, upon which they run with ſome celerity; and from the inſects, by their ſize; for though the Newt may be looked upon in this contemptible light, a Crocodile would be a terrible inſect indeed. Thus lizards are, in ſome meaſure, excluded from every rank; while they exhibit ſomewhat of the properties of all; the legs and celerity of the quadrupede; a facility of creeping through narrow and intricate ways, like the ſerpent; and a power of living in the water, like fiſhes: however, through endued with theſe various powers, they have no real advantages over any other claſs of animated nature; for what they gain in aptitude for one element, they loſe in their fitneſs for another. Thus, between both, they are an aukward, ungainly tribe; neither ſo alert upon land, nor ſo nimble in the water, as the reſpective inhabitants of either abode; and, indeed, this holds through all nature, that, in proportion as the ſeeming advantages of inferior animals are multiplied, their real ones are abridged; and all their inſtincts are weakened and loſt, by the variety of channels into which they are divided.

As lizards thus differ from every other claſs of animals, they alſo differ widely from each

other. With reſpect to ſize, no claſs of beings has its ranks ſo oppoſite. What, for inſtance, can be more removed than the ſmall Cameleon, an inch long, and the Alligator of the river Amazons, above twenty-ſeven feet? To an inattentive obſerver, they would appear entirely of different kinds; and Seba wonders how they ever came to be claſſed together.

The colour of theſe animals alſo is very various, as they are found of a hundred different hues, green, blue, red, cheſnut, yellow, ſpotted, ſtreaked, and marbled. Were colour alone capable of conſtituting beauty, the lizard would often pleaſe; but there is ſomething ſo repreſſing in the animal's figure, that the brilliancy of its ſcales, or the variety of its ſpots, only tend to give an air of more exquiſite venom of greater malignity. The figure of theſe animals is not leſs various: ſometimes ſwolen in the belly; ſometimes purſed up at the throat; ſometimes with a rough ſet of ſpines on the back, like the teeth of a ſaw; ſometimes with teeth, at others with none; ſometimes venomous, at others harmleſs, and even philanthropic: ſometimes ſmooth and even; ſometimes with a long, ſlender tail; and often with a ſhorter blunt one.

But their greateſt diſtinction ariſes from their manner of bringing forth their young. Firſtly

ſome of them are viviparous. Secondly, ſome are oviparous; and which may be conſidered in three diſtinct ways. Thirdly, ſome bring forth ſmall ſpawn, like fiſhes. The Crocodile, the Iguana, and all the larger kinds, bring forth eggs, which are hatched by the heat of the ſun: the animals that iſſue from them are complete upon leaving the ſhell; and their firſt efforts are to run to ſeek food in their proper element. The viviparous kinds, in which are all the ſalamanders, come forth alive from the body of the female, perfect and active, and ſuffer no ſucceeding change. But thoſe which are bred in the water, and, as we have reaſon to think, from ſpawn, ſuffer a very conſiderable change in their form. They are produced with an external ſkin or covering, that ſometimes encloſes their feet, and gives them a ſerpentine appearance. To this falſe ſkin, fins are are added, above and below the tail, that ſerve the animal, for ſwimming; but when the falſe ſkin drops off, theſe drop off alſo; and then the lizard, with its four feet, is completely formed, and forſakes the water.

From hence it appears, that of this tribe there are three diſtinct kinds, differently produced, and moſt probably very different in their formation. But the hiſtory of theſe animals is

very obſcure; and we are as yet incapable of laying the line that ſeparates them. All we know, as was ſaid before, is, that the great animals of this kind are *moſtly* produced perfect from the egg; the ſalamanders are *generally* viviparous; and *ſome* of the water lizards imperfectly produced. In all theſe moſt unfiniſhed productions of Nature, if I may ſo call them, the varieties in their ſtructure encreaſes in proportion to their imperfections. A poet would ſay, that Nature grew tired of the nauſeous formation; and left accident to finiſh the reſt of her handy work.

However, the three kinds have many points of ſimilitude; and, in all their varieties of figure, colour, and production, this tribe is eaſily diſtinguiſhed, and ſtrongly marked. They have all four ſhort legs; the two fore feet ſomewhat reſembling a man's hand and arm. They have tails almoſt as thick as the body at the beginning, and that generally run tapering to a point. They are all amphibious alſo; equally capable of living upon land and water; and formed internally in the ſame manner with the tortoiſe, and other animals, that can continue a long time without reſpiration: in other words, their lungs are not ſo neceſſary to continue life and circulation,

but that their play may be ſtopped for ſome conſiderable time, while the blood performs its circuit round the body by a ſhorter communication.

Theſe are differences that ſufficiently ſeparate lizards from all other animals; but it will be very difficult to fix the limits that diſtinguiſh the three kinds from each other. The *crocodile* tribe, and its affinities, are ſufficiently diſtinguiſhed from all the reſt, by their ſize and fierceneſs; the *ſalamander* tribe is diſtinguiſhed by their deformity, their frog-like heads, the ſhortneſs of their ſnouts, their ſwolen belly, and their viviparous production. With regard to the reſt, which we may denominate the cameleon or lizard kind, ſome of which bring forth from the egg, and ſome of which are imperfectly formed from ſpawn, we muſt groupe them under one head, and leave time to unravel the reſt of their hiſtory.

CHAP.

C H A P. V.

Of the Crocodile and its Affinities.

THE Crocodile is an animal placed at a happy diſtance from the inhabitants of Europe, and formidable only in thoſe regions where men are ſcarce, and arts are but little known. In all the cultivated and populous parts of the world, the great animals are entirely baniſhed, or rarely ſeen. The appearance of ſuch raiſes at once a whole country up in arms to oppoſe their force; and their lives generally pay the forfeit of their temerity. The crocodile, therefore, that was once ſo terrible along the banks of the river Nile, is now neither ſo large, nor its numbers ſo great as formerly. The arts of mankind have, through a courſe of ages, powerfully operated to its deſtruction; and, though it is ſometimes ſeen, it appears comparatively timorous and feeble.

To look for this animal in all its natural terrors, grown to an enormous ſize, propagated in ſurpriſing numbers, and committing unceaſing devaſtations, we muſt go to the uninhabited regions of Africa and America, to thoſe immenſe rivers that roll through ex-

E. Marvin sc.

1. The Crocodile. *V. 7. p: 118.*

2. The Crocodiles Egg. *V. 7. p. 134.*

tenſive and deſolate kingdoms, where arts have never penetrated, where force only makes diſtinction, and the moſt powerful animals exert their ſtrength with confidence and ſecurity. Thoſe that ſail up the river Amazons, or the river Niger, well know how numerous and terrible thoſe animals are in ſuch parts of the world. In both theſe rivers, they are found from eighteen to twenty-ſeven feet long; and ſometimes lying as cloſe to each other, as a raft of timber upon one of our ſtreams. There they indolently baſk on the ſurface, no way diſturbed at the approach of an enemy, ſince, from the repeated trials of their ſtrength, they found none that they were not able to ſubdue.

Of this terrible animal there are two kinds; the Crocodile, properly ſo called, and the Cayman or Alligator. Travellers, however, have rather made the diſtinction than Nature; for in the general outline, and in the nature of theſe two animals they are entirely the ſame. It would be ſpeaking more properly to call theſe animals the Crocodiles of the eaſtern and the weſtern world; for in books of voyages, they are ſo entirely confounded together, that there is no knowing whether the Aſiatic animal be the crocodile of Aſia, or the alligator of the weſtern world. The diſtinctions uſually made between

the crocodile and alligator are theſe: the body of the crocodile is more ſlender than that of the alligator; its ſnout runs off tapering from the forehead, like that of a greyhound; while that of the other is indented, like the noſe of a lap-dog. The crocodile has a much wider ſwallow, and is of an aſh-colour; the alligator is black, varied with white, and is thought not to be ſo miſchievous. All theſe diſtinctions, however, are very ſlight, and can be reckoned little more than minute variations.

This animal grows to a great length, being ſometimes found thirty feet long, from the tip of the ſnout to the end of the tail: its moſt uſual length, however, is eighteen. One which was diſſected by the Jeſuits at Siam was of the latter dimenſions; and as the deſcription which is given of it, both externally and internally, is the moſt accurate known of this noted animal, I muſt beg leave to give it as I find it, though ſomewhat tedious. It was eighteen feet and an half, French meaſure, in length; of which the tail was no leſs than five feet and an half, and the head and neck above two feet and an half. It was four feet nine inches in circumference, where thickeſt. The fore legs had the ſame parts and conformation as the arms of a man, both within and without. The

hands, if they may be fo called, had five fingers; the two laft of which had no nails, and were of a conical figure. The hinder legs, including the thigh and paw, were two feet two inches long; the paws, from the joint to the extremity of the longeft claws, were above nine inches: they were divided into four toes, of which three were armed with large claws, the longeft of which was an inch and an half: thefe toes were united by a membrane, like thofe of a duck, but much thicker. The head was long, and had a little rifing at the top; but the reft was flat, and efpecially towards the extremity of the jaws. It was covered by a fkin, which adhered firmly to the fkull and to the jaws. The fkull was rough and unequal in feveral places; and about the middle of the forehead there were two bony crefts, about two inches high: the fkull between thefe two crefts was proof againft a mufquet-ball; for it only rendered the part a little white that it ftruck againft. The eye was very fmall, in proportion to the reft of the body, and was fo placed within its orbit, that the outward part, when the lid was clofed, was only an inch long, and the line running parallel to the opening of the jaws. It was covered with a double lid, one within and one without: that within, like the nictitating membrane in birds, was folded in the great corner of the eye, and had

a motion towards the tail, but being tranſ-parent, it covered the eye without hindering the ſight. The iris was very large in proportion to the globe of the eye, and was of a yellowiſh grey colour. Above the eye the ear was placed, which opened from above downwards, as if it were by a kind of ſpring, by means of a ſolid, thick, cartilaginous ſubſtance. The noſe was placed in the middle of the upper jaw, near an inch from its extremity, and was perfectly round and flat, being near two inches in diameter, of a black, ſoft, ſpongy ſubſtance, not unlike the noſe of a dog. The jaws ſeemed to ſhut one within another; and nothing can be more falſe than that the animal's under jaw is without mo-tion; it moves, like the lower jaw in all other animals, while the upper is fixed to the ſkull and abſolutely immoveable. The animal had twenty-ſeven cutting teeth in the upper jaw, and fifteen in the lower, with ſeveral void ſpaces between them: they were thick at the bottom, and ſharp at the point, being all of different ſizes, except ten large hooked ones, ſix of which were in the lower jaw, and four in the upper. The mouth was fifteen inches in length, and eight and an half in breadth, where broadeſt. The diſtance of the two jaws, when opened as wide as they could be, was fifteen inches and a half: this is a very wide yawn, and could eaſily enough take in the

body of a man. The colour of the body was of a dark brown on the upper part, and of a whitiſh citron below, with large ſpots of both colours on the ſides. From the ſhoulders to the extremity of the tail, the animal was covered with large ſcales, of a ſquare form, diſpoſed like parallel girdles, and fifty-two in number; but thoſe near the tail were not ſo thick as the reſt. The creature was covered not only with theſe, but all over with a coat of armour; which, however, was not proof againſt a muſquet-ball, contrary to what has been commonly aſſerted: however, it muſt be confeſſed, that the attitude in which the animal was placed, might contribute to render the ſkin more penetrable; for probably if the ball had ſtruck obliquely againſt the ſhell, it would have flown off. Thoſe parts of the girdles underneath the belly were of a whitiſh colour, and were made up of ſcales of divers ſhapes, but not ſo hard as thoſe on the back.

With reſpect to the internal parts of the animal, the gullet was large in proportion to the mouth; and a ball of wood, as large as one's head, readily ran down, and was drawn up again. The guts were but ſhort, in compariſon, being not ſo long as the animal's body. The tongue, which ſome have erroneouſly aſſerted

this animal was without, consisted of a thick spongy soft flesh, and was strongly connected to the lower jaw. The heart was of the size of a calf's, of a bright red colour, the blood passing as well from the veins to the aorta as into the lungs. There was no bladder; but the kidneys sent the urine to be discharged by the anus. There were sixty-two joints in the back-bone, which, though very closely united, had sufficient play to enable the animal to bend like a bow to the right and the left; so that what we hear of escaping the creature by turning out of the right line, and of the animal's not being able to wheel readily after its prey, seems to be fabulous. It is most likely the crocodile can turn with great ease, for the joints of its back are not stiffer than those of other animals which we know by experience can wheel about very nimbly for their size.

Such is the figure and conformation of this formidable animal, that unpeoples countries, and makes the most navigable rivers desart and dangerous. They are seen, in some places, lying for whole hours, and even days, stretched in the sun, and motionless; so that one not used to them, might mistake them for trunks of trees, covered with a rough and dry bark; but the mistake would soon be fatal, if not pre-

vented: for the torpid animal, at the near approach of any living thing, darts upon it with inſtant ſwiftneſs, and at once drags it down to the bottom. In the times of an inundation, they ſometimes enter the cottages of the natives, where the dreadful viſitant ſeizes the firſt animal it meets with. There have been ſeveral examples of their taking a man out of a canoe in the ſight of his companions, without their being able to lend him any aſſiſtance.

The ſtrength of every part of the crocodile is very great; and its arms, both offenſive and defenſive, irreſiſtible. We have ſeen, from the ſhortneſs of its legs, the amazing ſtrength of the tortoiſe: but what is the ſtrength of ſuch an animal, compared to that of the crocodile, whoſe legs are very ſhort and whoſe ſize is ſo ſuperior. The back-bone is jointed in the firmeſt manner; the muſcles of the fore and hinder legs are vigorous and ſtrong; and its whole form calculated for force. Its teeth are ſharp, numerous, and formidable; its claws are long and tenaceous; but its principal inſtrument of deſtruction is the tail: with a ſingle blow of this it has often overtuned a canoe, and ſeized upon the poor ſavage its conductor.

Though not ſo powerful, yet it is very terrible even upon land. The crocodile ſeldom,

except when preſſed by hunger, or with a view, of depoſiting its eggs, leaves the water. Its uſual method is to float along upon the ſurface and ſeize whatever animals come within its reach; but when this method fails, it then goes cloſer to the bank. Diſappointed of its fiſhy prey, it there waits covered up among the ſedges, in patient expectation of ſome land animal that comes to drink; the dog, the bull, the tiger, or man himſelf. Nothing is to be ſeen of the inſiduous deſtroyer as the animal approaches; nor is its retreat diſcovered till it be too late for ſafety. It ſeizes the victim with a ſpring, and goes at a bound much faſter than ſo unwieldy an animal could be thought capable of exerting; then having ſecured the creature with both teeth and claws, it drags it into the water, inſtantly ſinks with it to the bottom, and in this manner quickly drowns it.

Sometimes it happens that the creature the crocodile has thus ſurpriſed eſcapes from its graſp wounded, and makes off from the riverſide. In ſuch a caſe, the tyrant purſues with all its force, and often ſeizes it a ſecond time; for though ſeemingly heavy, the crocodile runs with great celerity. In this manner it is ſometimes ſeen above half a mile from the bank, in

purſuit of an animal wounded beyond the power of eſcaping, and then dragging it back to the river-ſide, where it feaſts in ſecurity.

It often happens, in its depredations along the bank, that the crocodile ſeizes on a creature as formidable as itſelf, and meets with a moſt deſperate reſiſtance. We are told of frequent combats between the crocodile and the tiger. All creatures of the tiger kind are continually oppreſſed by a parching thirſt that keeps them in the vicinity of great rivers, whither they deſcend to drink very frequently. It is upon theſe occaſions that they are ſeized by the crocodile; and they die not unrevenged. The inſtant they are ſeized upon, they turn with the greateſt agility, and force their claws into the crocodile's eyes, while he plunges with his fierce antagoniſt into the river. There they continue to ſtruggle for ſome time, till at laſt the tiger is drowned.

In this manner the crocodile ſeizes and deſtroys all animals, and is equally dreaded by all. There is no animal but man alone that can combat it with ſucceſs. We are aſſured by Labat, that a Negro, with no other weapons than a knife in his right hand, and his left arm wrapped round with a cow hide, ventures boldly to attack this animal in its own element. As ſoon

as he approaches the crocodile, he presents his left arm, which the animal swallows most greedily; but sticking in its throat, the Negro has time to give it several stabs under the throat; and the water also getting in it at the mouth, which is held involuntarily open, the creature is soon bloated up as big as a tun, and expires.

To us who live at a distance from the rapacity of these animals, these stories appear strange, and yet most probably are true. From not having seen any thing so formidable or bold in the circle of our own experience, we are not to determine upon the wonderful transactions in distant climates. It is probable that these, and a number of more dreadful encounters, happen every day among those forests and in those rivers where the most formidable animals are known to reside; where the elephant and the rhinoceros, the tiger and the hippopotamos the shark and the crocodile, have frequent opportunities of meeting and ever day of renewing their engagements.

Whatever be the truth of these accounts, certain it is that crocodiles are taken by the Siamese in great abundance. The natives of that empire seem particularly fond of the capture of all the great animals with which their country abounds. We have already seen their success

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in taking and taming the elephant; nor are they lefs powerful in exerting their dominion over the crocodile. The manner of taking it in Siam is by throwing three or four ftrong nets acrofs a river, at proper diftances from each other; fo that if the animal breaks through the firft, it may be caught by one of the reft. When it is firft taken, it employs the tail, which is the grand inftrument of ftrength, with great force; but after many unfuccefsful ftruggles, the animal's ftrength is at laft exhaufted. Then the natives approach their prifoner in boats, and pierce him with their weapons in the moft tender parts till he is weakened with the lofs of blood. When he has done ftirring, they begin by tying up his mouth, and with the fame cord they faften his head to his tail, which laft they bend back like a bow. However, they are not yet perfectly fecure from his fury; but, for their greater fafety, they tie his fore feet as well as thofe behind to the top of his back. Thefe precautions are not ufelefs; for if they were to omit them, the crocodile would foon recover ftrength enough to do a great deal of mifchief.

The crocodile thus brought into fubjection, or bred up young, is ufed to divert and entertain the great men of the Eaft. It is often

managed like an horfe; a curb is put into its mouth, and the rider directs it as he thinks proper. Though aukwardly formed, it does not fail to proceed with fome degree of fwiftnefs; and is thought to move as faft as fome of the moft unwieldy of our own animals, the hog or the cow. Some, indeed, affert that no animal could efcape it, but for its difficulty in turning; but to this refource we could wifh none would truft who are fo unhappy as to find themfelves in danger.

Along the rivers of Africa this animal is fometimes taken in the fame manner as the fhark. Several Europeans go together in a large boat, and throw out a piece of beef upon a hook and ftrong fortified line, which the crocodile feizing and fwallowing, is drawn along, floundering and ftruggling until its ftrength is quite exhaufted, when it is pierced in the belly, which is its tendereft part; and thus after numberlefs wounds is drawn afhore. In this part of the world alfo, as well as at Siam, the crocodile makes an object of favage pomp near the palaces of their monarchs. Philips informs us that at Sabi, on the Slave Coaft, there are two pools of water near the royal palace, where crocodiles are bred as we breed carp in our ponds in Europe.

Hitherto I have been defcribing the crocodile as it is found in unpeopled countries, and undifturbed by frequent encounters with mankind. In this ftate it is fierce and cruel, attacking every object that feems endued with motion: but in Egypt, and other countries long peopled, where the inhabitants are civilized and the rivers frequented, this animal is folitary and fearful. So far from coming to attack a man, it finks at his approach with the utmoft precipitation; and, as if fenfible of fuperior power, ever declines the engagement. We have feen more than one inftance in animated nature of the contempt which at firft the lower orders of the creation have for man, till they have experienced his powers of deftruction. The lion and the tiger among beafts, the whale among fifhes, the albatrofs and the penguin among birds, meet the firft encounters of man without dread or apprehenfion; but they foon learn to acknowledge his fuperiority; and take refuge from his power in the deepeft faftneffes of nature. This may account for the different characters which have been given us of the crocodile and the alligator by travellers at different times: fome defcribing them as harmlefs and fearful, as ever avoiding the fight of a man, and preying only upon fifhes; others ranking them among the deftroyers of

nature; describing them as furnished with strength and impelled by malignity to do mischief; representing them as the greatest enemies of mankind, and particularly desirous of human prey. The truth is, the animal has been justly described by both; being such as it is found in places differently peopled or differently civilized. Wherever the crocodile has reigned long unmolested, it is there fierce, bold, and dangerous; wherever it has been harrassed by mankind, its retreats invaded, and its numbers destroyed, it is there timorous and inoffensive.

In some places, therefore, this animal, instead of being formidable, is not only inoffensive, but is cherished and admired. In the river San Domingo, the crocodiles are the most inoffensive animals in nature; the children play with them, and ride about on their backs; they even beat them sometimes without receiving the smallest injury. It is true the inhabitants are very careful of this gentle breed, and consider them as harmless domestics.

It is probable that the smell of musk, which all these animals exhale, may render them agreeable to the savages of that part of Africa. They are often known to take the part of this animal which contains the musk, and wear it as a per-

fume about their perfons. Travellers are not agreed in what part of the body thefe mufk-bags are contained; fome fay in the ears; fome, in the parts of generation; but the moft probable opinion is, that this mufky fubftance is amaffed in glands under the legs and arms. From whatfoever part of the body this odour proceeds, it is very ftrong and powerful, tincturing the flefh of the whole body with its tafte and fmell. The crocodile's flefh is at beft very bad tough eating; but unlefs the mufk-bags be feparated it is infupportable. The Negroes themfelves cannot well digeft the flefh; but then, a crocodile's egg is to them the moft delicate morfel in the world. Even favages exhibit their epicures as well as we; and one of true tafte will fpare neither pains nor danger to furnifh himfelf with his favourite repaft. For this reafon, he often watches the places where the female comes to lay her eggs, and upon her retiring feizes the booty.

All crocodiles breed near frefh waters; and though they are fometimes found in the fea, yet that may be confidered rather as a place of excurfion than abode. They produce their young by eggs, as was faid above; and for this purpofe the female when fhe comes to lay, chooses a place by the fide of a river, or fome

fresh water lake, to deposit her brood in. She always pitches upon an extensive sandy shore, where she may dig a hole without danger of detection from the ground being fresh turned up. The shore must also be gentle and shelving to the water, for the greater convenience of the animal's going and returning; and a convenient place must be found near the edge of the stream, that the young may have a shorter way to go. When all these requisites are adjusted, the animal is seen cautiously stealing up on shore to deposit her burthen. The presence of a man, a beast, or even a bird, is sufficient to deter her at that time; and if she perceives any creature looking on, she infallibly returns. If, however, nothing appears, she then goes to work, scratching up the sand with her fore paws, and making a hole pretty deep in the shore. There she deposits from eighty to an hundred eggs, of the size of a tennis-ball, and of the same figure, covered with a tough white skin like parchment. She takes above an hour to perform this task; and then covering up the place so artfully that it can scarcely be perceived, she goes back to return again the next day. Upon her return, with the same precaution as before, she lays about the same number of eggs; and the day following also a like number. Thus having

depoſited her whole quantity, and having co-vered them cloſe up in the ſand, they are ſoon vivified by the heat of the ſun; and at the end of thirty days, the young ones begin to break open the ſhell. At this time the female is inſtinctively taught that her young ones want relief; and ſhe goes up on land to ſcratch away the ſand and ſet them free. Her brood quickly avail themſelves of their liberty; a part run unguided to the water; another part aſcend the back of the female, and are carried thither in greater ſafety. But the moment they arrive at the water, all natural connexion is at an end: when the female has introduced her young to their natural element, not only ſhe, but the male, become among the number of their moſt formidable enemies, and devour as many of them as they can. The whole brood ſcatters into different parts at the bottom; by far the greateſt number are deſtroyed; and the reſt find ſafety in their agility or minuteneſs.

But it is not the crocodile alone that is thus found to thin their numbers; the eggs of this animal are not only a delicious feaſt to the ſavage, but are eagerly ſought after by every beaſt and bird of prey. The ichneumon was erected into a deity among the ancients for its ſucceſs in deſtroying the eggs of theſe monſters:

at preſent that ſpecies of the vulture called the Gallinazo is their moſt prevailing enemy. All along the banks of great rivers, for thouſands of miles the crocodile is ſeen to propagate in numbers that would ſoon over-run the earth but for the vulture, that ſeems appointed by Providence to abridge its fecundity. Theſe birds are ever found in greateſt numbers where the crocodile is moſt numerous; and hiding themſelves within the thick branches of the trees that ſhade the banks of the river, they watch the female in ſilence, and permit her to lay all her eggs without interruption. Then when ſhe has retired, they encourage each other with cries to the ſpoil; and flocking all together upon the hidden treaſure, tear up the eggs, and devour them in a much quicker time than they were depoſited. Nor are they leſs diligent in attending the female while ſhe is carrying her young to the water; for if any one of them happens to drop by the way, it is ſure to receive no mercy.

Such is the extraordinary account given us by late travellers of the propagation of this animal; an account adopted by Linnæus and the moſt learned naturaliſts of the age *. Yet, if one might argue from the general analogy

* Ulloa.

of nature, the crocodile's devouring her own young when ſhe gets to the water ſeems doubtful. This may be a ſtory raiſed from the general idea of this animal's rapacious cruelty; when, in fact, the crocodile only ſeems more cruel than other animals becauſe it has more power to do miſchief. It is probable that it is not more diveſted of parental tenderneſs than other creatures; and I am the more led to think ſo from the peculiar formation of one of the crocodile kind. This is called the Open Bellied Crocodile, and is furniſhed with a falſe belly like the opoſſum, where the young creep out and in as their dangers or neceſſities require. The crocodile thus furniſhed at leaſt cannot be ſaid to be an enemy to her own young, ſince ſhe thus gives them more than parental protection. It is probable alſo that this Open Bellied Crocodile is viviparous, and foſters her young that are prematurely excluded in this ſecond womb, until they come to proper maturity.

How long the crocodile lives we are not certainly informed; if we may believe Ariſtotle, it lives the age of a man; but the ancients ſo much amuſed themſelves in inventing fables concerning this animal, that even truth from them is ſuſpicious. What we know for certain from the ancients is, that among the various

animals that were produced to fight in the amphitheatre at Rome, the combat of the crocodile was not wanting *. Marcus Scaurus produced them living in his unrivalled exhibitions; and the Romans confidered him as the beft citizen, becaufe he furnifhed them with the moft expenfive entertainments. But entertainment at that corrupt time was their only occupation.

* Plin. lib. viii. c. 26.

CHAP.

CHAP. VI.

Of the Salamander.

THE ancients have defcribed a lizard that is bred from heat, that lives in the flames, and feeds upon fire as its proper nourifhment. As they faw every other element, the air, the earth and water, inhabited, fancy was fet to work to find or make an inhabitant in fire; and thus to people every part of nature. It will be needlefs to fay that there is no fuch animal exifting; and that, of all others, the modern Salamander has the fmalleft affinity to fuch an abode.

Whether the animal that now goes by the name of the falamander be the fame with that defcribed by Pliny, is a doubt with me; but this is not a place for the difcuffion. It is fufficient to obferve, that the modern falamander is an animal of the lizard kind, and under this name is comprehended a large tribe that all go by the fame name. There have been not lefs than feven forts of this animal defcribed by Seba; and to have fome idea of the peculiarity of their figure, if we fuppofe the tail of a lizard applied to the body of a frog, we fhall not be far from precifion. The common lizard is long, fmall

and taper; the ſalamander, like the frog, has its eyes towards the back of the head; like the frog, its ſnout is round and not pointed, and its belly thick and ſwolen. The claws of its toes are ſhort and feeble; its ſkin rough; and the tongue, unlike that of the ſmalleſt of the lizard kind, in which it is long and forked, is ſhort, and adhering to the under jaw.

But it is not in figure that this animal chiefly differs from the reſt of the lizard tribe; for it ſeems to differ in nature and conformation. In nature it is unlike, being an heavy, torpid animal; whereas the lizard tribe are active, reſtleſs, and ever in motion: in conformation it is unlike, as the ſalamander is produced alive from the body of its parent, and is completely formed the moment of its excluſion. It differs from them alſo in its general reputation of being venomous; however, no trials that have been hitherto made ſeem to confirm the truth of the report.

Not only this, but many others of the lizard tribe are ſaid to have venom; but it were to be wiſhed that mankind, for their own happineſs, would examine into the foundation of this reproach. By that means many of them, that are now ſhunned and deteſted, might be found inoffenſive; their figure, inſtead of exciting either

horror or diſguſt, would then only tend to animate the general ſcene of nature; and ſpeculation might examine their manners in confidence and ſecurity. Certain it is, that all of the lizard kind with which we are acquainted in this country, are perfectly harmleſs; and it is equally true that, for a long time, till our prejudices were removed, we conſidered not only the Newt, but the Snake and the Blind-worm, as fraught with the moſt deſtructive poiſon. At preſent we have got over theſe prejudices; and, it is probable, that, if other nations made the ſame efforts for information, it would be found, that the malignity of moſt, if not all, of the lizard tribe, was only in the imagination.

With reſpect to the Salamander, the whole tribe, from the Moron to the Gekko, are ſaid to be venomous to the laſt degree; yet, when experiments have been tried, no arts, no provocations, could excite theſe animals to the rage of biting. They ſeem timid and inoffenſive, only living upon worms and inſects; quite deſtitute of fangs, like the viper; their teeth are ſo very ſmall, that they are hardly able to inflict a wound. But as the teeth are thus incapable of offending, the people of the countries where they are found have recourſe to a venomous ſlaver, which, they ſuppoſe, iſſues

from the animal's mouth; they alſo tell us of a venom iſſuing from the claws: even Linnæus ſeems to acknowledge the fact; but thinks it a probable ſuppoſition that this venom may proceed from their urine.

Of all animals, the Gekko is the moſt notorious for its powers of miſchief: yet, we are told by thoſe who load it with that calumny, that it is very friendly to man, and though ſupplied with the moſt deadly virulence, is yet never known to bite. It would be abſurd in us, without experience, to pronounce upon the noxious or inoffenſive qualities of animals: yet it is moſt probable, from an inſpection of the teeth of lizards, and from their inoffenſive qualities in Europe, that the gekko has been unjuſtly accuſed; and that its ſerpent-like figure has involved it in one common reproach with ſerpents.

The ſalamander beſt known in Europe, is from eight to eleven inches long, uſually black, ſpotted with yellow; and when taken in the hand feeling cold to a great degree. There are ſeveral kinds. Our Black Water Newt is reckoned among the number. The idle report of its being inconſumable in fire, has cauſed many of theſe poor animals to be burnt; but we cannot ſay as philoſophical martyrs; ſince ſcarce any

philoſopher could think it neceſſary to make the experiment. When thrown into the fire, the animal is ſeen to burſt with the heat of its ſituation, and to eject its fluids. We are gravely told, in the Philoſophical Tranſactions, that this is a method the animal takes to extinguiſh the flames.

When examined internally, the ſalamander exhibits little different from other animals of the lizard kind. It is furniſhed with lungs that ſometimes ſerve for the offices of breathing; with a heart that has its communications open, ſo that the animal cannot eaſily be drowned. The ovary in the female is double the ſize of what it is in others of this tribe; and the male is furniſhed with four teſticuli inſtead of two. But what deſerves particular notice is the manner of this animal's bringing forth its young alive *. "The ſalamander," ſays my author, "begins "to ſhew itſelf in ſpring, and chiefly during "heavy rains. When the warm weather re-"turns, it diſappears; and never leaves its hole, "during either great heats or ſevere colds, "both which it equally fears. When taken in "the hand, it appears like a lump of ice; it "conſequently loves the ſhade, and is found

* Acta Hafnienſia. ann. 1676. Obſerv. 11. Memoires de l'Academie Royale des Sciences. tom. iii. part 3. p. 80.

"at the feet of old trees ſurrounded with bruſh-
"wood at the bottom. It is fond of running
"along new plowed grounds; probably to ſeek
"for worms, which are its ordinary food. One
"of theſe," continues my author, "I took
"alive ſome years ago in a ditch that had been
"lately made. I laid it at the foot of the ſtairs
"upon coming home, and there it diſgorged
"from the throat a *worm* three inches long,
"that lived for an hour after, though wounded
"as I ſuppoſe by the teeth of the animal. I
"afterwards cut up another of theſe lizards,
"and ſaw not leſs than fifty young ones, re-
"ſembling the parent, come from its womb,
"all alive, and actively running about the
"room." It were to be wiſhed the author had uſed another word beſide that of *worm*; as we now are in doubt whether he means a real worm, or a young animal of the lizard ſpecies: had he been more explicit, and had it appeared that it was a real young lizard, which I take to be his meaning, we might here ſee a wonder of Nature, brought to the proof which many have aſſerted, and many have thought proper to deny:—I mean the refuge which the young of the ſhark, the lizard, and the viper kinds, are ſaid to take, by running down the throat of the parent, and there finding a temporary ſecurity.

The

The fact, indeed, ſeems a little extraordinary; and yet it is ſo frequently atteſted by ſome, and even believed by others, whoſe authority is reſpectable, among the number of whom we find Mr. Pennant, that the argument of ſtrangeneſs muſt give way to the weight of authority.

However this be, there is no doubt of the animal's being viviparous, and producing above fifty at a time. They come from the parent in full perfection, and quickly leave her to ſhift for themſelves. Theſe animals, in the lower ranks of nature, want ſcarce any help when excluded; they ſoon complete the little circle of their education; and in a day or two are capable of practiſing all the arts of ſubſiſtence and evaſion practiſed by their kind.

They are all amphibious, or at leaſt are found capable of ſubſiſting in either element, when placed there: if thoſe taken from land are put into water, they continue there in ſeeming health; and, on the contrary, thoſe taken from the water will live upon land. In water, however, they exhibit a greater variety in their appearance; and what is equally wonderful with the reſt of their hiſtory, during the whole ſpring and ſummer this water lizard changes its ſkin every fourth or fifth day; and during the winter every fifteen days. This

operation they perform by means of the mout and the claws; and it ſeems a work of no ſmall difficulty and pain. The caſt ſkins are frequently ſeen floating on the ſurface of the water: they are ſometimes ſeen alſo with a part of their old ſkin ſtill ſticking to one of their limbs, which they have not been able to get rid of; and thus, like a man with a boot half drawn, in ſome meaſure crippled in their own ſpoils. This alſo often corrupts, and the leg drops off; but the animal does not ſeem to feel the want of it, for the loſs of a limb to all the lizard kind is but a trifling calamity. They can live ſeveral hours even after the loſs of their head: and for ſome time under diſſection, all the parts of this animal ſeem to retain life: but the tail is the part that longeſt retains its motion. Salt ſeems to be much more efficacious in deſtroying theſe animals, than the knife; for, upon being ſprinkled with it, the whole body emits a viſcous liquor, and the lizard dies in three minutes, in great agonies.

The whole of the lizard kind are alſo tenacious of life in another reſpect, and the ſalamander among the number. They ſuſtain the want of food in a ſurpriſing manner. One of them, brought from the Indies, lived nine months, without any other food than what it

received from licking a piece of earth on which it was brought over *: another was kept by Seba in an empty vial for six months, without any nourishment; and Redi talks of a large one, brought from Africa, that lived for eight months, without taking any nourishment whatever. Indeed, as many of this kind, both salamanders and lizards, are torpid, or nearly so, during the winter, the loss of their appetite for so long a time is the less surprising.

* Phil. Transf. ann. 1661. N. 21. art. 7.

CHAP. VII.

Of the Cameleon, Iguana, and Lizards of different Kinds.

IT were to be wiſhed that animals could be ſo claſſed, that by the very mentioning their rank, we ſhould receive ſome inſight into their hiſtory. This I have endeavoured in moſt inſtances; but in the preſent chapter all method is totally unſerviceable. Here diſtribution gives no general ideas: for ſome of the animals to be here mentioned produce by eggs; ſome by ſpawn; and ſome are viviparous. The peculiar manner of propagating in each, is very indiſtinctly known. The Iguana and the Cameleon, we know bring forth eggs; ſome others alſo produce in the ſame manner: but of the reſt, which naturaliſts make amount to above fifty, we have but very indiſtinct information.

In the former diviſions of this tribe, we had to obſerve upon animals, formidable from their ſize, or diſguſting from their frog-like head and appearance; in the preſent diviſion, all the animals are either beautiful to the eye, or grateful to the appetite. The lizards, properly ſo called, are beautifully painted and mottled;

their frolicſome agility is amuſing to thoſe who are familiar with their appearance; and the great affection which ſome of them ſhew to man, ſhould, in ſome meaſure, be repaid with kindneſs. Others, ſuch as the Iguana, though not poſſeſſed of beauty, are very ſerviceable, furniſhing one of the moſt luxurious feaſts the tropical climates can boaſt of. Thoſe treated of before were objects of curioſity, becauſe they were apparently objects of danger: moſt of theſe here mentioned have either uſe or beauty to engage us.

Directly deſcending from the crocodile, we find the Cordyle, the Tockay, and the Tejuguacu, all growing leſs in order, as I have named them. Theſe fill up the chaſm to be found between the crocodile and the African Iguana.

The Iguana, which deſerves our notice, is about five feet long, and the body about as thick as one's thigh: the ſkin is covered with ſmall ſcales, like thoſe of a ſerpent; and the back is furniſhed with a row of prickles, that ſtand up, like the teeth of a ſaw: the eyes ſeem to be but half opened, except when the animal is angry, and then they appear large and ſparkling: both the jaws are full of very ſharp teeth, and the bite is dangerous, though

not venomous, for it never lets loose till it is killed. The male has a skin hanging under his throat, which reaches down to his breast; and, when displeased, he puffs it up like a bladder: he is one third larger and stronger than the female; though the strength of either avails them little towards their defence. The males are ash-coloured, and the females are green.

The flesh of these may be considered as the greatest delicacy of Africa and America; and the sportsmen of those climates go out to hunt the iguana, as we do in pursuit of the pheasant or the hare. In the beginning of the season, when the great floods of the tropical climates are past away, and vegetation starts into universal verdure, the sportsmen are seen, with a nooze and a stick, wandering along the sides of the rivers, to take the iguana. This animal, though apparently formed for combat, is the most harmless creature of all the forest; it lives among the trees, or sports in the water, without ever offering to offend: there, having fed upon the flowers of the mahot, and the leaves of the mapou, that grow along the banks of the stream, it goes to repose upon the branches of the trees that hang over the water. Upon land the animal is swift of foot; but when once in possession of a tree, it seems conscious of the secu-

rity of its situation, and never offers to stir. There the sportsman easily finds it, and as easily fastens his nooze round its neck: if the head be placed in such a manner that the nooze cannot readily be fastened, by hitting the animal a blow on the nose with the stick, it lifts the head, and offers it in some measure to the nooze. In this manner, and also by the tail, the iguana is dragged from the trees, and killed by repeated blows on the head.

The Cameleon is a very different animal; and as the iguana satisfies the appetites of the epicure, this is rather the feast of the philosopher. Like the crocodile, this little animal proceeds from an egg; and it also nearly resembles that formidable creature in form; but it differs widely in its size and its appetites; being not above eleven inches long, and delighting to sit upon trees, being afraid of serpents, from which it is unable to escape on the ground.

The head of a large cameleon is almost two inches long; and from thence to the beginning of the tail, four and a half: the tail is five inches long, and the feet two and a half: the thickness of the body is different at different times; for sometimes, from the back to the belly, it is two inches, and sometimes but one; for it can blow itself up, and contract itself, at

pleasure. This swelling and contraction is not only of the back and belly, but of the legs and tail.

These different tumours do not proceed from a dilatation of the breast in breathing, which rises and falls by turns; but are very irregular, and seem adopted merely from caprice. The cameleon is often seen, as it were, blown up for two hours together; and then it continues growing less and less insensibly; for the dilatation is always more quick and visible than the contraction. In this last state the animal appears extremely lean; the spine of the back seems sharp, and all the ribs may be counted; likewise the tendons of the legs and arms may be seen very distinctly.

This method of puffing itself up, is similar to that in pigeons, whose crops are sometimes greatly distended with air. The cameleon has a power of driving the air it breathes over every part of the body: however, it only gets between the skin and the muscles; for the muscles themselves are never swolen. The skin is very cold to the touch; and though the animal seems so lean, there is no feeling the beating of the heart. The surface of the skin is unequal, and has a grain not unlike shagreen, but very soft, because each eminence is as smooth as if it were

polifhed. Some of thefe little protuberances are as large as a pin's head, on the arms, legs, belly, and tail; but on the fhoulders and head they are of an oval figure, and a little larger: thofe under the throat are ranged in the form of a chaplet, from the lower lip to the breaft. The colour of all thefe eminences, when the cameleon is at reft in a fhady place, is of a blueifh grey, and the fpace between is of a pale red and yellow.

But when the animal is removed into the fun, then comes the wonderful part of its hiftory. At firft it appears to fuffer no change of colour, its greyifh fpots ftill continuing the fame: but the whole furface foon feems to imbibe the rays of light; and the fimple colouring of the body changes into a variety of beautiful hues. Wherever the light comes upon the body, it is of a tawny brown; but that part of the fkin on which the fun does not fhine, changes into feveral brighter colours, pale yellow, or vivid crimfon; which form fpots of the fize of half one's finger: fome of thefe defcend from the fpine half way down the back; and others appear on the fides, arms, and tail. When the fun has done fhining, the original grey colour returns by degrees, and covers all the body. Sometimes the animal becomes all over

ſpotted with brown ſpots, of a greeniſh caſt. When it is wrapped up in a white linen cloth for two or three minutes, the natural colour becomes much lighter; but not quire white, as ſome authors have pretended: however, from hence it muſt not be concluded that the cameleon aſſumes the colour of the objects which it approaches; this is entirely an error, and probably has taken its riſe from the continual changes it appears to undergo.

Le Bruyn, in his Voyage to the Levant, has given us a very ample deſcription of the cameleon. During his ſtay at Smyrna, he bought ſeveral of this kind, and, to try how long they could live, kept four of them in a cage, permitting them at times to run about the houſe. The freſh ſea-breeze ſeemed to give them moſt ſpirits and vivacity; they opened their mouths to take it in: he never perceived that they eat any thing, except now and then a fly, which they took half an hour to ſwallow: he obſerved their colour often to change, three or four times ſucceſſively, without being able to find out any cauſe for ſuch alterations; their common colour he found to be grey, or rather a pale mouſe-colour; but its moſt frequent changes were into a beautiful green, ſpotted with yellow: ſometimes the animal was marked all over with dark

brown; and this often changed into a lighter brown: ſome colours, however, it never aſſumed; and, contrary to what was ſaid above, he found red to be among the number.

Though our traveller took the utmoſt care, he was unable to preſerve any of them alive above five months; and many of them died in four. When the cameleon changes place, and attempts to deſcend from an eminence, it moves with the utmoſt precaution, advancing one leg very deliberately before the other, ſtill ſecuring itſelf by holding whatever it can graſp by the tail. It ſeldom opens the mouth, except for freſh air; and when that is ſupplied, diſcovers its ſatisfaction by its motions, and the frequent changes of its colour. The tongue is ſometimes darted out after its prey, which is flies; and this is as long as the whole body. The eyes are remarkably little, though they ſtand out of the head: they have a ſingle eye-lid, like a cap with a hole in the middle, through which the ſight of the eye appears, which is of a ſhining brown; and round it there is a little circle of a gold colour; but the moſt extraordinary part of their conformation is, that the animal often moves one eye, when the other is entirely at reſt; nay, ſometimes one eye will ſeem to look directly forward, while the other looks back-

ward; and one will look upwards, while the other regards the earth.

To this claſs of lizards we may refer the Dragon, a moſt terrible animal, but moſt probably not of Nature's formation. Of this death-dealing creature all people have read; and the moſt barbarous countries, to this day, paint it to the imagination in all its terrors, and fear to meet it in every foreſt. It is not enough that Nature has furniſhed thoſe countries with poiſons of various malignity; with ſerpents forty feet long; with elephants, lions, and tigers, to make their ſituation really dangerous; the capricious imagination is ſet at work to call up new terrors; and ſcarce a ſavage is found, that does not talk of winged ſerpents of immoderate length, flying away with the camel or the rhinoceros, or deſtroying mankind by a ſingle glare. Happily, however, ſuch ravagers are no where found to exiſt at preſent; and the whole race of dragons is dwindled down to the Flying Lizard, a little harmleſs creature, that only preys upon inſects, and even ſeems to embelliſh the foreſt with its beauty.

The Flying Lizard of Java perches upon fruit-trees, and feeds upon flies, ants, butterflies, and other ſmall inſects. It is a very harmleſs creature, and does no miſchief in

any refpect. Gentil, in his Voyage round the World, affirms, that he has feen thefe lizards, at the ifland of Java, in the Eaft Indies. He obferved they flew very fwiftly from tree to tree; and having killed one, he could not but admire the fkin, which was painted with feveral beautiful colours: it was a foot in length, and had four paws, like the common lizards; but its head was flat, and had a fmall hole in the middle; the wings were very thin, and refembled thofe of a flying fifh. About the neck were a fort of wattles, not unlike thofe of cocks, which gave it no difagreeable appearance. He intended to have preferved it, in order to bring it into Europe; but it was corrupted by the heat, before the clofe of the day: however, they have fince been brought into England, and are now common enough in the cabinets of the curious.

The laft animal of the lizard kind that I fhall mention, is the Chalcidian Lizard of Aldrovandus, very improperly called the Seps, by modern hiftorians. This animal feems to make the fhade that feparates the lizard from the ferpent race. It has four legs, like the lizard; but fo fhort, as to be utterly unferviceable in walking: it has a long flender body, like the ferpent; and it is faid to have the ferpent's malignity alfo. The fore legs are very near the

head; the hind legs are placed far backward; but before and behind they ſeem rather uſeleſs incumbrances, than inſtruments ſerving to aſſiſt the animal in its motions, or in providing for its ſubſiſtence. Theſe animals are found above three feet long, and thick in proportion, with a large head and pointed ſnout. The whole body is covered with ſcales; and the belly is white, mixed with blue. It has four crooked teeth; as alſo a pointed tail, which, however, can inflict no wound. Whether the teeth be ſimilar to the viper's fangs, we are not told; though Volateranus ſays, they are covered with a membrane; by which I am apt to think he means a venom-bag, which is found at the root of the teeth of all ſerpents that are poiſonous. It is viviparous; fifteen young ones having been taken alive out of its belly. Upon the whole, it appears to bear a ſtrong affinity to the viper; and, like that animal, its bite may be dangerous.

CHAP.

CHAP. VIII.

Of Serpents in general.

WE now come to a tribe that not only their deformity, their venom, their ready malignity, but alſo our prejudices, and our very religion, have taught us to deteſt. The ſerpent has from the beginning been the enemy of man; and it has hitherto continued to terrify and annoy him, notwithſtanding all the arts which have been practiſed to deſtroy it. Formidable in itſelf, it deters the invader from the purſuit; and from its figure capable of finding ſhelter in a little ſpace, it is not eaſily diſcovered by thoſe who would venture to try the encounter. Thus poſſeſſed at once of potent arms and inacceſſible or ſecure retreats, it baffles all the arts of man, though never ſo earneſtly bent upon its deſtruction.

For this reaſon, there is ſcarce a country in the world that does not ſtill give birth to this poiſonous brood, that ſeem formed to quell human pride, and repreſs the boaſts of ſecurity. Mankind have driven the lion, the tiger and the wolf from their vicinity; but the ſnake and the viper ſtill defy their power, and frequently puniſh their inſolence.

Their numbers, however, are thinned by human assiduity; and it is possible some of the kinds are wholly destroyed. In none of the countries of Europe are they sufficiently numerous to be truly terrible; the philosopher can meditate in the fields without danger, and the lover seek the grove without fearing any wounds but those of metaphor. The various malignity that has been ascribed to European serpents of old, is now utterly unknown; there are not above three or four kinds that are dangerous, and their poison operates in all in the same manner. A burning pain in the part, easily removeable by timely applications, is the worst effect that we experience from the bite of the most venomous serpents of Europe. The drowsy death, the starting of the blood from every pore, the insatiable and burning thirst, the melting down the solid mass of the whole form into one heap of putrefaction, these are horrors with which we are entirely unacquainted.

But though we have thus reduced these dangers, having been incapable of wholly removing them, in other parts of the world they still rage with all their ancient malignity. Nature seems to have placed them as centinels to deter mankind from spreading too widely, and from seeking new abodes till they have thoroughly

cultivated those at home. In the warm countries that lie within the tropic, as well as in the cold regions of the north, where the inhabitants are few, the serpents propagate in equal proportion. But of all countries, those regions have them in the greatest abundance where the fields are unpeopled and fertile, and where the climate supplies warmth and humidity. All along the swampy banks of the river Niger or Oroonoko, where the sun is hot, the forests thick, and the men but few, the serpents cling among the branches of the trees in infinite numbers, and carry on an unceasing war against all other animals in their vicinity. Travellers have assured us that they have often seen large snakes twining round the trunk of a tall tree, encompassing it like a wreath, and thus rising and descending at pleasure. In these countries, therefore, the serpent is too formidable to become an object of curiosity, for it excites much more violent sensations.

We are not, therefore, to reject as wholly fabulous, the accounts left us by the ancients of the terrible devastations committed by a single serpent. It is probable, in early times, when the arts were little known, and mankind were but thinly scattered over the earth, that serpents, continuing undisturbed possessors of the forest, grew

to an amazing magnitude; and every other tribe of animals fell before them. It then might have happened, that ſerpents reigned the tyrants of a diſtrict for centuries together. To animals of this kind, grown by time and rapacity to an hundred or an hundred and fifty feet in length, the lion, the tiger, and even the elephant itſelf, were but feeble opponents. The dreadful monſter ſpread deſolation round him; every creature that had life was devoured, or fled to a diſtance. That horrible *fœtor* which even the commoneſt and the moſt harmleſs ſnakes are ſtill found to diffuſe, might, in theſe larger ones, become too powerful for any living being to withſtand; and while they preyed without diſtinction, they might thus alſo have poiſoned the atmoſphere around them. In this manner, having for ages lived in the hidden and unpeopled foreſt, and finding, as their appetites were more powerful, the quantity of their prey decreaſing, it is poſſible they might venture boldly from their retreats, into the more cultivated parts of the country, and carry conſternation among mankind, as they had before deſolation among the lower ranks of nature. We have many hiſtories of antiquity, preſenting us ſuch a picture; and exhibiting a whole nation ſinking under the ravages of a ſingle ſerpent. At that time man had not learned the art of uniting the efforts of

many, to effect one great purpofe. Oppofing multitudes only added new victims to the general calamity, and encreafed mutual embarraffment and terror. The animal was therefore to be fingly oppofed by him who had the greateft ftrength, the beft armour, and the moft undaunted courage. In fuch an encounter, hundreds muft have fallen; till one, more lucky than the reft, by a fortunate blow, or by taking the monfter in its torpid interval, and furcharged with fpoil, might kill, and thus rid his country of the deftroyer. Such was the original occupation of heroes; and thofe who firft obtained that name, from their deftroying the ravagers of the earth, gained it much more defervedly than their fucceffors, who acquired their reputation only for their fkill in deftroying each other. But as we defcend into more enlightened antiquity, we find thefe animals lefs formidable, as being attacked in a more fuccefsful manner. We are told, that while Regulus led his army along the banks of the river Bagrada in Africa, an enormous ferpent difputed his paffage over. We are affured by Pliny, who fays that he himfelf faw the fkin, that it was an hundred and twenty feet long, and that it had deftroyed many of the army. At laft, however, the battering engines were brought out againft it; and thefe affailing

it at a diſtance, it was ſoon deſtroyed. Its ſpoils were carried to Rome, and the general was decreed an ovation for his ſucceſs. There are, perhaps, few facts better aſcertained in hiſtory than this: an ovation was a remarkable honour; and was given only for ſome ſignal exploit, that did not deſerve a triumph: no hiſtorian would offer to invent that part of the ſtory at leaſt, without being ſubject to the moſt ſhameful detection. The ſkin was kept for ſeveral years after in the Capitol; and Pliny ſays, he ſaw it there: now, though Pliny was a credulous writer, he was by no means a *falſe* one; and whatever he ſays he has ſeen, we may very ſafely rely on. At preſent, indeed, ſuch ravages from ſerpents are ſcarce ſeen in any part of the world; not but that in Africa and America, ſome of them are powerful enough to brave the aſſaults of men to this day.

But happily for us, we are placed at ſuch a diſtance as to take a view of this tribe, without fearing for our ſafety; we can ſurvey their impotent malignity with the ſame delight with which the poet deſcribes the terrors of a dead monſter.

Nequeant expleri corda tuendo
Terribiles oculos villoſaque ſetis pectore.

To us their ſlender form, their undulating motion, their vivid colouring, their horrid ſtench, their forky tongue, and their envenomed

fangs, are totally harmlefs; and in this country their ufes even ferve to counterbalance the mif-chief they fometimes occafion.

If we take a furvey of ferpents in general, they have marks by which they are diftinguifhed from all the reft of animated nature. They have the length and the fupplenefs of the eel, but want fins to fwim with; they have the fcaly covering and pointed tail of the lizard, but they want legs to walk with; they have the crawling motion of the worm, but, unlike that animal, they have lungs to breathe with: like all the reptile kind, they are refentful when offended; and Nature has fupplied them with terrible arms to revenge every injury.

Though they are poffeffed of very different degrees of malignity, yet they are all formidable to man, and have a ftrong fimilitude of form to each other; and it will be proper to mark the general characters before we defcend to partulars. With refpect to their conformation, all ferpents have a very wide mouth, in proportion to the fize of the head; and what is very extraordinary, they can gape and fwallow the head of another animal which is three times as big as their own. I have feen a toad taken out of the belly of a fnake, at Lord Spencer's, near London, the body of which was thrice the

diameter of the animal that ſwallowed it. However, it is no way ſurpriſing that the ſkin of the ſnake ſhould ſtretch to receive ſo large a morſel; the wonder ſeems how the jaws could take it in. To explain this, it muſt be obſerved that the jaws of this animal do not open as ours, in the manner of a pair of hinges, where bones are applied to bones and play upon one another; on the contrary, the ſerpent's jaws are held together at the roots by a ſtretching muſcular ſkin; by which means they open as widely as the animal chuſes to ſtretch them, and admit of a prey much thicker than the ſnake's own body. The throat, like ſtretching leather, dilates to admit the morſel; the ſtomach receives it in part; and the reſt remains in the gullet, till putrefaction and the juices of the ſerpent's body unite to diſſolve it.

As to the teeth, I will talk more of them when I come to treat of the viper's poiſon; it will be ſufficient here to obſerve, that ſome ſerpents have fangs, or canine teeth, and others are without them. The teeth in all are crooked and hollow; and, by a peculiar contrivance, are capable of being erected or depreſſed at pleaſure.

The eyes of all ſerpents are ſmall, if compared to the length of the body; and though differently coloured in different kinds, yet the

appearance of all is malign and heavy; and from their known qualities, they ftrike the imagination with the idea of a creature meditating mifchief. In fome, the upper eye-lid is wanting, and the ferpent winks only with that below; in others, the animal has a nictitating membrane or fkin, refembling that which is found in birds, which keeps the eye clean and preferves the fight. The fubftance of the eye in all is hard and horny; the chryftalline humour occupying a great part of the globe.

The holes for hearing are very vifible in all: but there are no conduits for fmelling; though it is probable that fome of them enjoy that fenfe in tolerable perfection.

The tongue in all thefe animals is long and forky. It is compofed of two long flefhy fubftances, which terminate in fharp points, and are very pliable. At the root it is connected very ftrongly to the neck by two tendons, that give it a variety of play. Some of the viper kind have tongues a fifth part of the length of their bodies; they are continually darting them out, but they are entirely harmlefs, and only terrify thofe who are ignorant of the real fituation of their poifon.

If from the jaws we go on to the gullet, we

ſhall find it very wide for the animal's ſize, and capable of being diſtended to a great degree; at the bottom of this lies the ſtomach, which is not ſo capacious, and receives only a part of the prey, while the reſt continues in the gullet for digeſtion. When the ſubſtance in the ſtomach is diſſolved into chyle, it paſſes into the inteſtines, and from thence goes to nouriſhment, or to be excluded by the vent.

Like moſt other animals, ſerpents are furniſhed with lungs, which I ſuppoſe are ſerviceable in breathing, though we cannot perceive the manner in which this operation is performed; for though ſerpents are often ſeen apparently to draw in their breath, yet we cannot find the ſmalleſt ſigns of their ever reſpiring it again. Their lungs however are long and large, and doubtleſs are neceſſary to promote their languid circulation. The heart is formed as in the tortoiſe, the frog, and the lizard kinds, ſo as to work without the aſſiſtance of the lungs. It is ſingle, the greateſt part of the blood flowing from the great vein to the great artery by the ſhorteſt courſe. By this contrivance of Nature we eaſily gather two conſequences; that ſnakes are amphibious, being equally capable of living on land and in the water; and, that alſo they are torpid in winter, like the bat, the

lizard, and other animals formed in the ſame manner.

The vent in theſe animals ſerves for the emiſſion of the urine and the fæces, and for the purpoſes of generation. The inſtrument of generation in the male is double, being forked like the tongue; the ovaries in the female are double alſo; and the aperture is very large, in order to receive the double inſtrument of the male. They copulate in their retreats; and it is ſaid by the ancients, that in this ſituation they appear like one ſerpent with two heads; but how far this remark is founded in truth, I do not find any of the moderns that can reſolve me.

As the body of this animal is long, ſlender, and capable of bending in every direction, the number of joints in the back-bone are numerous beyond what one would imagine. In the generality of quadrupedes, they amount to not above thirty or forty; in the ſerpent kind they amount to an hundred and forty-five from the head to the vent, and twenty-five more from that to the tail *. The number of theſe joints muſt give the back-bone a ſurpriſing degree of pliancy; but this is ſtill encreaſed by the manner in which each of theſe joints are locked into the

* Vide Charat. Anatom.

other. In man and quadrupedes, the flat ſurfaces of the bones are laid one againſt the other, and bound tight by ſinews; but in ſerpents the bones play one within the other like ball and ſocket, ſo that they have full motion upon each other in every direction *. Thus if a man were to form a machine compoſed of ſo many joints as are found in the back of a ſerpent, he would find it no eaſy matter to give it ſuch ſtrength and pliancy at the ſame time. The chain of a watch is but a bungling piece of workmanſhip in compariſon.

Though the number of joints in the back-bone is great, yet that of the ribs is ſtill greater; for, from the head to the vent, there are two ribs to every joint, which makes their number two hundred and ninety in all. Theſe ribs are furniſhed with muſcles; four in number; which being inſerted into the head, run along to the end of the tail, and give the animal great ſtrength and agility in all its motions.

The ſkin alſo contributes to its motions, being compoſed of a number of ſcales, united to each other by a tranſparent membrane, which grows harder as it grows older, until the animal changes, which is generally done twice a year. This cover then burſts near the head, and the ſerpent

* Derham, p. 395.

creeps from it, by an undulatory motion, in a new ſkin, much more vivid than the former. If the old ſlough be then viewed, every ſcale will be diſtinctly ſeen, like a piece of net-work, and will be found greateſt where the part of the body they covered was largeſt.

There is much geometrical neatneſs in the diſpoſal of the ſerpent's ſcales, for aſſiſting the animal's ſinuous motion. As the edges of the foremoſt ſcales lie over the ends of their following ſcales, ſo thoſe edges, when the ſcales are erected, which the animal has a power of doing in a ſmall degree, catch in the ground, like the nails in the wheel of a chariot, and ſo promote and facilitate the animal's progreſſive motion. The erecting theſe ſcales is by means of a multitude of diſtinct muſcles, with which each is ſupplied, and one end of which is tacked each to the middle of the foregoing.

In ſome of the ſerpent kind there is the exacteſt ſymmetry in theſe ſcales; in others they are diſpoſed more irregularly. In ſome there are larger ſcales on the belly, and often anſwering to the number of ribs; in others, however, the animal is without them. Upon this ſlight difference, Linnæus has founded his diſtinctions of the various claſſes of the ſerpent tribe. Human curioſity, however, and even human in-

tereſt, ſeem to plead for a very different method of diſtribution. It is not the number of ſcales on a formidable animal's belly, nor their magnitude or variety, that any way excite our concern. The firſt queſtion that every man will naturally aſk, when he hears of a ſnake, is, whether it be large; the ſecond, whether it be venomous? In other words, the ſtrongeſt lines in the animal's hiſtory are thoſe that firſt excite our attention; and theſe it is every hiſtorian's buſineſs to diſplay.

When we come to compare ſerpents with each other, the firſt great diſtinction appears in their ſize; no other tribe of animals differing ſo widely in this particular. What, for inſtance, can be ſo remotely ſeparated as the Great Liboya of Surinam, that grows to thirty-ſix feet long; and the Little Serpent, at the Cape of Good Hope and the north of the river Senegal, that is not above three inches, and covers whole ſandy deſerts with its multitudes! This tribe of animals, like that of fiſhes, ſeems to have no bounds put to their growth: their bones are in a great meaſure cartilaginous, and they are conſequently capable of great extenſion; the older, therefore, a ſerpent becomes, the larger it grows; and as they ſeem to live to a great age, they arrive at an enormous ſize.

Leguat aſſures us, that he ſaw one in Java, that was fifty feet long. Carli mentions their growing to above forty feet; and we have now the ſkin of one in the Muſæum, that meaſures thirty-two. Mr. Wentworth, who had large concerns in the Brebices in America, aſſures me, that, in that country, they grow to an enormous length. He one day ſent out a ſoldier, with an Indian, to kill wild fowl for the table; and they accordingly went ſome miles from the fort: in purſuing their game, the Indian, who generally marched before, beginning to tire, went to reſt himſelf upon the fallen trunk of a tree, as he ſuppoſed it to be; but when he was juſt going to ſit down, the enormous monſter began to move, and the poor ſavage perceiving that he had approached a Liboya, the greateſt of all the ſerpent kind, dropped down in an agony. The ſoldier, who perceived at ſome diſtance what had happened, levelled at the ſerpent's head, and, by a lucky aim, ſhot it dead: however, he continued his fire until he was aſſured that the animal was killed; and then going up to reſcue his companion, who was fallen motionleſs by its ſide, he, to his aſtoniſhment, found him dead likewiſe, being killed by the fright. Upon his return to the fort, and telling what had hap-

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pened, Mr Wentworth ordered the animal to be brought up, when it was meaſured, and found to be thirty-ſix feet long. He had the ſkin ſtuffed, and then ſent to Europe, as a preſent to the Prince of Orange, in whoſe cabinet it is now to be ſeen at the Hague; but the ſkin has ſhrunk, by drying, two or three feet.

In the Eaſt Indies they grow alſo to an enormous ſize; particularly in the Iſland of Java, where, we are aſſured, that one of them will deſtroy and devour a buffalo. In a letter, printed in the German Ephemerides, we have an account of a combat between an enormous ſerpent and a buffalo, by a perſon, who aſſures us, that he was himſelf a ſpectator. The ſerpent had for ſome time been waiting near the brink of a pool, in expectation of its prey; when a buffalo was the firſt that offered. Having darted upon the affrighted animal, it inſtantly began to wrap it round with its voluminous twiſtings; and at every twiſt the bones of the buffalo were heard to crack almoſt as loud as the report of a cannon. It was in vain that the poor animal ſtruggled and bellowed; its enormous enemy entwined it too cloſely to get free; till at length, all its bones being maſhed to pieces, like thoſe of a malefactor on the wheel, and the whole body reduced to one

uniform mafs, the ferpent untwined its folds to fwallow its prey at leifure. To prepare for this, and in order to make the body flip down the throat more glibly, it was feen to lick the whole body over, and thus cover it with its mucus. It then began to fwallow it at that end that offered leaft refiftance; while its length of body was dilated to receive its prey, and thus took in at once a morfel that was three times its own thicknefs. We are affured by travellers, that thefe animals are often found with the body of a ftag in their gullet, while the horns, which they are unable to fwallow, keep fticking out at their mouths.

But it is happy for mankind that the rapacity of thefe frightful creatures is often their punifhment; for whenever any of the ferpent kind have gorged themfelves in this manner, whenever their body is feen particularly diftended with food, they then become torpid, and may be approached and deftroyed with fafety. Patient of hunger to a furprifing degree, whenever they feize and fwallow their prey, they feem, like furfeited gluttons, unwieldy, ftupid, helplefs, and fleepy: they at that time feek fome retreat, where they may lurk for feveral days together, and digeft their meal in fafety: the fmalleft effort at that time is capable of deftroying them; they can fcarce make any refift-

ance: and they are equally unqualified for flight or oppofition: that is the happy opportunity of attacking them with fuccefs; at that time the naked Indian himfelf does not fear to affail them. But it is otherwife when this fleepy interval of digeftion is over; they then iffue, with famifhed appetites, from their retreats, and with accumulated terrors, while every animal of the foreft flies before them.

Carli defcribes the Long Serpent of Congo, making its track through the tall grafs, like mowers in a fummer's day. He could not without terror behold whole lines of grafs lying levelled under the fweep of its tail. In this manner it moved forward with great rapidity, until it found a proper fituation frequented by its prey: there it continued to lurk, in patient expectation, and would have remained for weeks together, had it not been difturbed by the natives.

Other creatures have a choice in their provifion; but the ferpent indifcriminately preys upon all; the buffalo, the tiger, and the gazelle. One would think that the porcupine's quills might be fufficient to protect it; but whatever has life, ferves to appeafe the hunger of thefe devouring creatures: porcupines, with all their quills, have frequently been found in their ftomachs, when killed and opened; nay, they moft frequently are feen to devour each other.

A life

A life of savage hostility in the forest, offers the imagination one of the most tremendous pictures in nature. In those burning countries, where the sun dries up every brook for hundreds of miles round; when what had the appearance of a great river in the rainy season, becomes, in summer, one dreary bed of sand; in those countries, I say, a lake that is never dry, or a brook that is perennial, is considered by every animal as the greatest convenience of nature. As to food, the luxuriant landscape supplies that in sufficient abundance: it is the want of water that all animals endeavour to remove; and inwardly parched by the heat of the climate, traverse whole deserts to find out a spring. When they have discovered this, no dangers can deter them from attempting to slake their thirst. Thus the neighbourhood of a rivulet, in the heart of the tropical continents, is generally the place where all the hostile tribes of nature draw up for the engagement. On the banks of this little envied spot, thousands of animals of various kinds are seen venturing to quench their thirst, or preparing to seize their prey. The elephants are perceived in a long line, marching from the darker parts of the forest; the buffalos are there, depending upon numbers for security; the gazelles relying solely upon their swiftness;

the lion and tiger waiting a proper opportunity to ſeize; but chiefly the larger ſerpents are upon guard there, and defend the acceſſes of the lake. Not an hour paſſes without ſome dreadful combat; but the ſerpent, defended by its ſcales, and naturally capable of ſuſtaining a multitude of wounds, is, of all others, the moſt formidable. It is the moſt wakeful alſo; for the whole tribe ſleep with their eyes open, and are conſequently for ever upon the watch: ſo that, till their rapacity is ſatisfied, few other animals will venture to approach their ſtation.

But though theſe animals are, of all others, the moſt voracious; and though the morſel which they ſwallow without chewing, is greater than what any other creature, either by land or water, the whale itſelf not excepted, can devour, yet no animals upon earth bear abſtinence ſo long as they. A ſingle meal, with many of the ſnake kind, ſeems to be the adventure of a ſeaſon; it is an occurrence for which they have been for weeks, nay ſometimes for months, in patient expectation of. When they have ſeized their prey, their induſtry for ſeveral weeks is entirely diſcontinued; the fortunate capture of an hour, often ſatisfies them for the remaining period of their annual activity. As their blood is colder than that of moſt other terreſtrial animals, and as it circulates but ſlowly through

their bodies, so their powers of digestion are but feeble. Their prey continues, for a long time, partly in the stomach, partly in the gullet; and a part is often seen hanging out of the mouth. In this manner it digests by degrees; and in proportion as the part below is dissolved, the part above is taken in. It is not therefore till this tedious operation is entirely performed, that the serpent renews its appetite and its activity. But should any accident prevent it from issuing once more from its cell, it still can continue to bear famine, for weeks, months, nay for years together. Vipers are often kept in boxes for six or eight months, without any food whatever; and there are little serpents sometimes sent over to Europe, from Grand Cairo, the name of which I have not been able to learn, that live for several years in glasses, and never eat at all, nor even stain the glass with their excrement. Thus the serpent tribe unite in themselves two very opposite qualities; wonderful abstinence, and yet incredible rapacity.

If leaving the consideration of their appetites, we come to compare serpents as to their voices, some are found silent, some have a peculiar cry, but hissing is the sound which they most commonly send forth, either as a call to their kind, or as a threat to their enemies. In the countries

where they abound, they are generally ſilent in the middle of the day, when they are obliged to retire from the heat of the climate; but as the cool of the evening approaches, they are then heard iſſuing from their cells, with continued hiſſings; and ſuch is the variety of their notes, that ſome have aſſured me they very much reſemble the muſic of an Engliſh grove. This, ſome will hardly credit: at any rate, ſuch notes, however pleaſing, can give but very little delight, when we call to mind the malignity of the minſtrel. If conſidered indeed, as they anſwer the animal's own occaſions, they will be found well adapted to its nature, and fully anſwering the purpoſes of terrifying ſuch as would venture to offend it.

With reſpect to motion, ſome ſerpents, particularly thoſe of the viper kind, move ſlowly; while others, ſuch as the Ammodytes, dart with amazing ſwiftneſs. The motion in all is ſimilar; but the ſtrength of body in ſome gives a very different appearance. The viper, that is but a ſlow, feeble-bodied animal, makes way in a heavy undulating manner; advancing its head, then drawing up its tail behind, and bending the body into a bow; then from the ſpot where the head and tail were united, advancing the head forward as before. This, which is the

motion of all ferpents, is very different from that of the earth-worm, or the naked fnail. The ferpent, as was faid above, has a back-bone, with numerous joints; and this bone the ainmal has a power of bending in every direction, but without being able to fhorten or lengthen it at pleafure. The earth-worm, on the other hand, has no back-bone; but its body is compofed of rings, which, like a barber's puff, it can lengthen or fhorten as it finds neceffary. The earth-worm, therefore, in order to move forward, lengthens the body; then, by the fore-part clings to the ground, where it has reached, and then contracts and brings up its rear: then, when the body is thus fhortened, the fore-part is lengthened again for another progreffion; and fo on. The ferpent, inftead of fhortening the body, bends it into an arch; and this is the principal difference between ferpentine and vermicular progreffion.

I have inftanced this motion in the viper, as moft eafily difcerned; but there are many ferpents that dart with fuch amazing fwiftnefs, that they appear rather to leap than crawl. It is moft probable, however, that no ferpent can dart upon even ground farther than its own length at one effort. Our fears indeed, may encreafe the force of their fpeed, which is fome-

times found so fatal. We are told by some, that they will dart to a very great distance; but this my enquiries have never been able to ascertain. The manner of progression in the swiftest serpent we know, which is the Jaculus, is by instantly coiling itself upon its tail, and darting from thence to its full extent; then carrying the tail, as quick as lightning, to the head; coiling and darting again: and by this means proceeding, with extreme rapidity, without ever quitting the ground. Indeed, if we consider the length and the weakness of the back-bone in all these animals; if we regard the make of their vertebræ, in which we shall find the junctures all formed to give play, and none to give power; we cannot be of opinion that they have a faculty of springing from the ground, as they entirely want a *fulcrum*, if I may so express it, from whence to take their spring; the whole body being composed of unsupported muscles and joints that are yielding. It must be confessed, that they dart down from trees upon their prey; but their weight alone is sufficient for that purpose, without much effort of their own.

Though all serpents are amphibious, some are much fonder of the water than others; and though destitute of fins or gills, remain at the bottom, or swim along the surface with great ease. From their internal structure, just sketched

above, we ſee how well adapted they are for either element; and how capable their blood is of circulating at the bottom, as freely as in the frog or the tortoiſe. They can, however, endure to live in freſh-water only; for ſalt is an effectual bane to the whole tribe. The greateſt ſerpents are moſt uſually found in freſh-water, either chuſing it as their favourite element, or finding their prey in ſuch places in the greateſt abundance. But that all will live and ſwim in liquids, appears from the experiment of Redi; who put a ſerpent into a large glaſs veſſel of wine, where it lived ſwimming about ſix hours; though, when it was by force immerſed and kept under that liquid, it lived only one hour and an half. He put another in common water, where it lived three days; but when it was kept under water, it lived only about twelve hours *. Their motion there, however, is perfectly the reverſe of what it is upon land; for, in order to ſupport themſelves upon an element lighter than their bodies, they are obliged to encreaſe their ſurface in a very artificial manner. On earth their windings are perpendicular to the ſurface; in water they are parallel to it: in other words, if I ſhould wave my hand up and down, it will give an idea of the animal's progreſs on land; if

* Redi, Exper. p. 170.

I ſhould wave it to the right and left, it will give ſome idea of its progreſs on the water.

Some ſerpents have a moſt horrible fætor attending them, which is alone capable of intimidating the brave. This proceeds from two glands near the vent, like thoſe in the weaſel or polecat; and, like thoſe animals, in proportion as they are excited by rage or by fear, the ſcent grows ſtronger. It would ſeem, however, that ſuch ſerpents as are moſt venomous, are leaſt offenſive in this particular; ſince the rattleſnake and the viper have no ſmell whatever: nay, we are told, that at Calecut and Cranganon, in the Eaſt Indies, there are ſome very noxious ſerpents, who are ſo far from being diſagreeable, that their excrements are ſought after, and kept as the moſt pleaſing perfume. The Eſculapian Serpent is alſo of this number.

Some ſerpents bring forth their young alive; as the viper: ſome bring forth eggs, which are hatched by the heat of their ſituation; as the Common Black Snake, and the majority of the ſerpent tribe. When a reader, ignorant of anatomy, is told, that ſome of thoſe animals produce their young alive, and that ſome produce eggs only, he is apt to ſuppoſe a very great difference in the internal conformation, which makes ſuch a variety in the manner of

bringing forth. But this is not the cafe: thefe animals are internally alike, in whatever manner they produce their young; and the variety in their bringing forth, is rather a flight than a real difcrimination. The only difference is, that the viper hatches her eggs, and brings them to maturity within her body; the fnake is more premature in her productions, and fends her eggs into the light, fome time before the young ones are capable of leaving the fhell. Thus, if either are opened, the eggs will be found in the womb, covered with their membranous fhell, and adhering to each other, like large beads on a ftring. In the eggs of both the young ones will be found, though at different ftages of maturity: thofe of the viper will crawl and bite in the moment the fhell that enclofes them is broke open; thofe of the fnake are not yet arrived at their perfect form.

Father Labat took a ferpent of the viper kind, that was nine feet long, and ordered it to be opened in his prefence. He then faw the manner in which the eggs of thefe animals lie in the womb. In this creature there were fix eggs, each of the fize of a goofe egg, but longer, more pointed, and covered with a membranous fkin, by which alfo they were united to each other. Each of thefe eggs contained from thirteen to fifteen young ones,

about fix inches long, and as thick as a goofe-quill. Though the female from whence they were taken was fpotted, the young feemed to have a variety of colours very different from the parent; and this led the traveller to fuppofe that the colour was no characteriftic mark among ferpents. Thefe little mifchievous animals were no fooner let loofe from the fhell, than they crept about, and put themfelves into a threatning pofture, coiling themfelves up and biting the ftick with which he was deftroying them. In this manner he killed feventy-four young ones; thofe that were contained in one of the eggs efcaped at the place where the female was killed, by the burfting of the egg and their getting among the bufhes.

The laft diftinction that I fhall mention, but the moft material among ferpents is, that fome are venomous and fome inoffenfive. If we confider the poifon of ferpents as it relates to man, there is no doubt but that it is a fcourge and an affliction. The various calamities that the poifon of ferpents is capable of producing, are not only inflicted by the animal itfelf, but by men more mifchievous even than ferpents, who prepare their venom to deftroy each other. With this the favages poifon their arms, and alfo prepare their revengeful potions. The ancients were known to preferve it for the purpofes of fuicide;

and even among ſemi-barbarous countries at this day, the venom of ſnakes is uſed as a philtre.

But, though the poiſon be juſtly terrible to us, it has been given to very good purpoſes for the animal's own proper ſupport and defence. Without this, ſerpents of all other animals would be the moſt expoſed and defenceleſs; without feet for eſcaping a purſuit; without teeth capable of inflicting a dangerous wound, or without ſtrength for reſiſtance; incapable, from their ſize, of finding ſecurity in very ſmall retreats like the earth-worm, and diſguſting all from their deformity, nothing was left for them but a ſpeedy extirpation. But furniſhed as they are with powerful poiſon, every rank of animals approach them with dread, and never ſeize them but at an advantage. Nor is this all the advantage they derive from it. The malignity of a few ſerves for the protection of all. Though not above a tenth of their number are actually venomous, yet the ſimilitude they all bear to each other excites a general terror of the whole tribe; and the uncertainty of their enemies in which the poiſon chiefly reſides makes even the moſt harmleſs formidable. Thus Providence ſeems to have acted with double precaution; it has given ſome of them poiſon for the general defence of a tribe naturally feeble; but it has

thinned the numbers of thoſe which are venomous, leſt they ſhould become too powerful for the reſt of animated nature.

From theſe noxious qualities in the ſerpent kind, it is no wonder that not only man, but beaſts and birds, carry on an unceaſing war againſt them. The ichneumon of the Indians, and the peccary of America, deſtroy them in great numbers. Theſe animals have the art of ſeizing them near the head; and it is ſaid that they can ſkin them with great dexterity. The vulture and the eagle alſo prey upon them in great abundance; and often ſouſing down from the clouds drop upon a long ſerpent, which they ſnatch us ſtruggling and writhing in the air. Dogs alſo are bred up to oppoſe them. Father Feuillée tells us, that being in the woods of Martinico, he was attacked by a large ſerpent, which he could not eaſily avoid, when his dog immediately came to his relief, and ſeized the aſſailant with great courage. The ſerpent entwined him, and preſſed him ſo violently that the blood came out of his mouth, and yet the dog never ceaſed till he had tore it to pieces. The dog was not ſenſible of his wounds during the fight; but ſoon after his head ſwelled prodigiouſly, and he lay on the ground as dead. But his maſter

having found hard by a banana tree, he applied its juice, mixed with treacle, to the wounds; which recovered the dog, and quickly healed his sores.

But it is in man that these venomous creatures find the most dangerous enemy. The Psylli of old were famous for charming and destroying serpents. Some moderns pretend to the same art. Casaubon says, that he knew a man who could at any time summon an hundred serpents together, and draw them into the fire. Upon a certain occasion, when one of them bigger than the rest would not be brought in, he only repeated his charm, and it came forward, like the rest, to submit to the flames. Philostratus describes particularly how the Indians charm serpents. "They take a scarlet robe "embroidered with golden letters, and spread "it before a serpent's hole. The golden "letters have a fascinating power; and by "looking stedfastly, the serpent's eyes are "overcome and laid asleep." These and many other feats have been often practised upon these animals by artful men, who had first prepared the serpents for their exercise, and then exhibited them as adventitiously assembled at their call. In India there is nothing so common as dancing serpents, which are carried about in a

broad flat veſſel ſomewhat reſembling a ſieve. Theſe erect and put themſelves in motion at the word of command. When their keeper ſings a ſlow tune, they ſeem by their heads to keep time; when he ſings a quicker meaſure, they appear to move more briſk and lively. All animals have a certain degree of docility; and we find that ſerpents themſelves can be brought to move and approach at the voice of their maſter. From this trick ſucceſsfully practiſed before the ignorant, it is moſt probable has ariſen all the boaſted pretenſions which ſome have made to charming of ſerpents; an art to which the native Americans pretend at this very day. One of Linnæus's pupils we are told purchaſed the ſecret from an Indian, and then diſcovered it to his maſter; but, like all ſecrets of the kind, it is probable this ended in a few unmeaning words of no efficacy.

Though the generality of mankind regard this formidable race with horror, yet there have been ſome nations, and there are ſome at this day, that conſider them with veneration and regard. The adoration paid by the ancient Egyptians to a ſerpent is well known: many of the nations at preſent along the weſtern coaſt of Africa retain the ſame unaccountable veneration. Upon the gold and ſlave coaſts, a ſtranger,

upon entering the cottages of the natives, is often ſurpriſed to ſee the roof ſwarming with ſerpents, that cling there without moleſting and unmoleſted by the natives. But his ſurprize will encreaſe upon going farther ſouthward to the kingdom of Widah, when he finds that a ſerpent is the god of the country. This animal, which travellers deſcribe as a huge overgrown creature, has its habitation, its temple, and its prieſts. Theſe impreſs the vulgar with an opinion of its virtues; and numbers are daily ſeen to offer not only their goods, their proviſions, and their prayers, at the ſhrine of their hideous deity, but alſo their wives and daughters. Theſe the prieſts readily accept of, and after ſome days of penance, return them to their ſuppliants, much benefited by the ſerpent's ſuppoſed embraces. Such a complicated picture of ignorance and impoſture gives no very favourable impreſſions of our fellow-creatures; but we may ſay, in defence of human nature, that the moſt frightful of reptiles is worſhipped by the moſt uncultivated and barbarous of mankind.

From this general picture of the ſerpent tribe, one great diſtinction obviouſly preſents itſelf; namely, into thoſe that are venomous and thoſe that are wholly deſtitute of poiſon.

To the firſt belong the viper, the rattleſnake, the cobra di capello, and all their affinities: to the other, the common black ſnake, the liboya, the boiguacu, the amphiſbæna, and various others that, though deſtitute of venom, do not ceaſe to be formidable. I will therefore give their hiſtory ſeparately, beginning with the venomous claſs, as they have the ſtrongeſt claims to our notice and attention.

CHAP. IX.

Of venomous Serpents in general.

THE poiſon of ſerpents has been for ages one of the greateſt objects of human conſideration. To us who ſeldom feel the vengeful wound, it is merely a ſubject of curioſity; but to thoſe placed in the midſt of the ſerpent tribe, who are every day expoſed to ſome new diſaſter, it becomes a matter of the moſt ſerious importance. To remedy the bite of a ſerpent is conſidered among our phyſicians as one of the ſlighteſt operations in medicine; but among the phyſicians of the Eaſt, the antidotes for this calamity make up the bulk of their diſpenſaries. In our colder climates, the venom does not appear with that inſtantaneous operation which it exhibits in the warmer regions; for either its powers are leſs exquiſite, or our fluids are not carried round in ſuch rapid circulation.

In all countries, however, the poiſon of the ſerpent is ſufficiently formidable to deſerve notice, and to excite our attention to its nature and effects. It will therefore in the firſt place be proper to deſcribe its ſeat in the animal, as alſo the inſtrument by which the wound is made

and the poiſon injected. In all this venomous claſs of reptiles, whether the viper, the rattle-ſnak, or the cobra di capello, there are two large teeth or fangs that iſſue from the upper jaw, and that hang out beyond the lower. The reſt of the ſnake tribe are deſtitute of theſe; and it is moſt probable that wherever theſe fangs are wanting, the animal is harmleſs; on the contrary, wherever they are found it is to be avoided as the moſt peſtilent enemy. Theſe are the inſtruments that ſeem to place the true diſtinction between animals of the ſerpent kind; the wounds which theſe fangs inflict produce the moſt dangerous ſymptoms; the wounds inflicted by the teeth only are attended with nothing more than the ordinary conſequences attending the bite of any other animal. Our firſt great attention, therefore, upon ſeeing a ſerpent ſhould be directed to the teeth. If it has the fang teeth, it is to be placed among the venomous claſs; if it wants them, it may be ſet down as inoffenſive. I am not ignorant that many ſerpents are ſaid to be dangerous whoſe jaws are unfurniſhed with fangs; but it is moſt probable that our terrors only have furniſhed theſe animals with venom; for of all the tribe whoſe teeth are thus formed, not one will be found to have a bag for containing poiſon, n[illegible]

duit for injecting it into the wound. The Black Snake, the Liboya, the Blind Worm, and a hundred others that might be mentioned, have their teeth of an equal ſize, fixed into the jaws, and with no other apparatus for inflicting a dangerous wound than a dog or a lizard; but it is otherwiſe with the venomous tribe we are now deſcribing; theſe are well furniſhed, not only with an elaboratory where the poiſon is formed, but a canal by which it is conducted to the jaw, a bag under the tooth for keeping it ready for every occaſion, and alſo an aperture in the tooth itſelf for injecting it into the wound. To be more particular, the glands that ſerve to fabricate this venomous fluid are ſituated on each ſide of the head behind the eyes, and have their canals leading from thence to the bottom of the fangs in the upper jaw, where they empty into a kind of bladder, from whence the fangs on each ſide are ſeen to grow. The venom contained in this bladder is a yellowiſh thick taſteleſs liquor, which injected into the blood is death, yet which may be ſwallowed without any danger.

The fangs that give the wound come next under obſervation; they are large in proportion to the ſize of the animal that bears them; crooked, yet ſharp enough to inflict a ready

wound. They grow one on each ſide, and ſometimes two from two moveable bones in the upper jaw, which by ſliding backward or forward, have a power of erecting or depreſſing the teeth at pleaſure. In theſe bones are alſo fixed many teeth, but no way venomous, and only ſerving to take and hold the animal's prey. Beſides this apt diſpoſition of the fangs, they are hollow within, and have an opening towards the point like the ſlit of a pen, through which when the fang is preſſed down upon the bladder where it grows, there is ſeen to iſſue a part of the venom that lay below. To deſcribe this operation at once, when the ſerpent is irritated to give a venomous wound, it opens its formidable jaws to the wideſt extent; the moveable bones of the upper jaw ſlide forward; the fangs that lay before inclining are thus erected; they are ſtruck with force into the fleſh of the obnoxious perſon; by meeting reſiſtance at the points, they preſs upon the bladders of venom from whence they grow; the venom iſſues up through the hollow of the tooth; and is preſſed out through its ſlit into the wound, which by this time the tooth has made in the ſkin. Thus from a ſlight puncture, and the infuſion of a drop of venom ſcarce larger than the head of a pin, the part is quickly enflamed, and without

a proper antidote, the whole frame contaminated.

The appearances which this venom produces are different, according to the ſerpent that wounds, or the ſeaſon, or the ſtrength of the animal that ſtrikes the blow. If a viper inflicts the wound, and the remedy be neglected, the ſymptoms are not without danger. It firſt cauſes an acute pain in the place affected, attended with a ſwelling, firſt red, and afterwards livid. This by degrees ſpreads to the neighbouring parts; great faintneſs and a quick, though low and interrupted, pulſe enſues: to this ſucceed great ſickneſs at the ſtomach, bilious and convulſive vomitings, cold ſweats, pains about the navel, and death itſelf. But the violence of theſe ſymptoms depend much on the ſeaſon of the year, the difference of the climate, the ſize or rage of the animal, and the depth and ſituation of the wound. Theſe ſymptoms are much more violent, and ſucceed each other more rapidly after the bite of a rattle-ſnake; but when the perſon is bit by the cobra di capello, he dies in an hour, his whole frame being diſſolved into a putrid maſs of corruption.

Nothing ſurely can more juſtly excite our wonder than that ſo ſmall a quantity of venom ſhould produce ſuch powerful and deadly effects.

If the venom itſelf be examined through a microſcope, it will be found to ſhoot into little chryſtals that, to an imagination already impreſſed with its potency, look like ſo many darts fit for entering the blood-veſſels, and wounding their tender coats. But all theſe darts are wholly of our own making; the ſofteſt mildeſt fluid whatever, poſſeſſed of any conſiſtency, will form chryſtals under the eye of the microſcope, and put on an appearance exactly like the venom of the viper. In fact, this venom has no acrid taſte whatever; and to all experiments that our ſenſes can make upon it, appears a ſlimy inſipid fluid. Charas, who often taſted it, aſſures us of the fact; and aſſerts, that it may be taken inwardly without any ſenſible effects or any prejudice to the conſtitution. But the famous experiments that were tried by Redi and others, in the preſence of the Great Duke of Tuſcany and his court, put this beyond any doubt whatſoever. By theſe it appeared, that the ſerpent having once bitten, exhauſted for that time the greateſt part of its poiſon; and though the wound cauſed by its biting a ſecond time was attended with ſome malignant ſymptoms, yet they were much milder than before. It appeared that the ſerpent biting upon a ſponge, or a piece of ſoft bread, and then biting

a dog immediately after, did not inflict a wound more dangerous than the prick of a needle. It appeared that the venom being collected, and a needle dipped therein, this produced almoſt as painful effects as the tooth of the animal itſelf. But what cauſed the greateſt ſurprize in the court was the ſeeming raſhneſs of one Tozzi, a viper-catcher; who while the philoſophers were giving elaborate lectures on the danger of the poiſon when taken internally, boldly deſired a large quantity of it might be put together; and then with the utmoſt confidence, drank it off before them all. The court was ſtruck with aſtoniſhment, and expected that the man would inſtantly fall dead; but they ſoon perceived their miſtake, and found that taken in this manner the poiſon was as harmleſs as water; ſo true is that famous paſſage of Lucan,

Noxia ſerpentum eſt admixto ſanguine peſtis:
Morſu virus habent, et fatum in dente minantur:
Pocula morte carent.

What then ſhall we ſay to the ſpeedy effect of ſo ſeemingly harmleſs a liquid taken into the circulation? Let us firſt obſerve, that milk is one of the moſt mild and nouriſhing of all fluids, and ſeemingly the moſt friendly to the human conſtitution; yet if milk be injected into a vein,

it will quickly become fatal, and kill with more certain deſtruction than even the venom of the viper. From hence then we may infer, that the introducing not only the ſerpentine venom, but alſo a quantity of any other mixture, into the circulation, will be fatal; and that, conſequently, ſerpents kill as well by their power of injecting the wound as by the potency of their poiſon. Some indeed may inject a more acrimonious mixture, and this may produce more ſpeedy effects; but any mixture thus injected would be dangerous, and many would be fatal.

Ray gives us an inſtance of the potency of the ſerpent poiſon; which, though it has all the air of a fable, I cannot help tranſcribing. "A gentleman who went over to the Eaſt-"Indies, while he was one day ſitting among "ſome friends, was accoſted by an Indian "juggler, who offered to ſhew him ſome ex-"periments reſpecting the venom of ſerpents; "an exhibition uſual enough in that country. "Having firſt, therefore, produced a large ſer-"pent, he aſſured the company that it was "harmleſs; and to convince them of what he "ſaid, he tied up his arm, as is uſual with thoſe "who are going to be bled, and whipped the "ſerpent till it was provoked to bite him. "Having drawn in this manner about half a

"ſpoonful of blood from his arm, he put the "congealed clot upon his thigh. He then took "out a much ſmaller ſerpent, which was no "other than the cobra di capello; and having "tied up its neck, he procured about half a "drop of its venom, which he ſprinkled on "the clot of blood on his thigh, which inſtantly "began to ferment and bubble, and ſoon "changed colour from a red into a yellow."

This he pretended was cauſed by the extreme malignity of that animal's venom; however, I have no doubt that the whole is either a fable, or a trick of the Indian; who, while he ſeemed to mix the ſerpent's venom, actually infuſed ſome ſtronger ingredient, ſome mineral acid, into the maſs of blood, which was capable of working ſuch a change. It cannot be ſuppoſed that any animal poiſon could act ſo powerfully upon the blood already drawn and coagulated; for a poiſon that could operate thus inſtantaneouſly upon cold blood, could not fail of ſoon deſtroying the animal itſelf.

Be this as it will, the effects of ſerpent poiſon are but too well known, though the manner of operation be not ſo clear. As none of this malignant tribe grow to a great ſize, the longeſt of them not exceeding nine feet, they ſeldom ſeek the combat with larger animals, or offend

others till they are firſt offended. Did they exert their malignity in proportion to their power, they could eaſily drive the ranks of nature before them; but they ſeem unconſcious of their own ſuperiority, and rather fly than offer to meet the meaneſt oppoſer. Their food chiefly conſiſts of ſmall prey, ſuch as birds, moles, toads and lizards; ſo that they never attack the more formidable animals that would ſeldom die unrevenged. They lurk therefore in the clefts of rocks, or among ſtony places; they twine round the branches of trees, or ſun themſelves in the long graſs at the bottom. There they only ſeek repoſe and ſafety. If ſome unwary traveller invades their retreats, their firſt effort is to fly; but when either purſued or accidently trod upon, they then make a fierce and fatal reſiſtance. For this purpoſe, they raiſe themſelves according to their ſtrength upon their tail, erect their head, ſeize the limb that preſſes them, the wound is given and the head withdrawn in a moment. It is not therefore without reaſon, that the Aſiatics, who live in regions where ſerpents greatly abound, wear boots and long cloaths, which very well protect their lower parts from the accidental reſentment of their reptile annoyers.

In the eaſtern and weſtern Indies, the number

of noxious ſerpents is various; in this country we are acquainted only with one. The viper is the only animal in Great Britain from whoſe bite we have any thing to fear. In the tropical climates, the rattle-ſnake, the whip-ſnake, and the cobra di capello, are the moſt formidable, though by no means the moſt common. From the general notoriety of theſe particular ſerpents, and the univerſal terror which they occaſion, it would ſeem that few others are poſſeſſed of ſuch powerful malignity.

Vipers are found in many parts of this iſland; but the dry, ſtony, and in particular the chalky, countries abound with them. This animal ſeldom grows to a greater length than two feet; though ſometimes they are found above three. The ground colour of their bodies is a dirty yellow; that of the female is deeper. The back is marked the whole length with a ſeries of rhomboid black ſpots, touching each other at the points; the ſides with triangular ones, the belly entirely black. It is chiefly diſtinguiſhed from the common black ſnake by the colour, which in the latter is more beautifully mottled, as well as by the head, which is thicker than the body; but particularly by the tail, which in the viper, though it ends in a point, does not run tapering to ſo great a length

as in the other. When, therefore, other diſtinctions fail, the difference of the tail can be diſcerned at a ſingle glance.

The viper differs from moſt other ſerpents in being much ſlower, as alſo in excluding its young compleatly formed, and bringing them forth alive. The kindneſs of Providence ſeems exerted not only in diminiſhing the ſpeed, but alſo the fertility, of this dangerous creature. They copulate in May, and are ſuppoſed to be about three months before they bring forth, and have ſeldom above eleven eggs at a time. Theſe are of the ſize of a blackbird's eggs, and chained together in the womb like a ſtring of beads. Each egg contains from one to four young ones; ſo that the whole of a brood may amount to about twenty or thirty. They continue in the womb till they come to ſuch perfection as to be able to burſt from the ſhell; and they are ſaid by their own efforts to creep from their confinement into the open air, where they continue for ſeveral days without taking any food whatſoever. "We have been often "aſſured," ſays Mr. Pennant, "by intelligent "people, of the truth of a fact, that the young "of the viper when terrified will run down the "throat of the parent, and ſeek ſhelter in its "belly in the ſame manner as the young of the

"oppoſſum retire into the ventral pouch of the "old one. From this," continues he, "ſome "have imagined that the viper is ſo unnatural "as to devour its own young; but this deſerves "no credit, as theſe animals live upon frogs, "toads, lizards, and young birds, which they "ſwallow whole, though the morſel is often "three times as thick as their own body."

The viper is capable of ſupporting very long abſtinence, it being known that ſome have been kept in a box ſix months without food; yet during the whole time they did not abate of their vivacity. They feed only a ſmall part of the year, but never during their confinement; for if mice, their favourite diet, ſhould at that time be thrown into their box, though they will kill, yet they will never eat them. When at liberty, they remain torpid throughout the winter; yet, when confined, have never been obſerved to take their annual repoſe. Their poiſon, however, decreaſes in proportion to the length of their confinement; and it is thought, that the virtues of the animal's fleſh are, by the ſame reſtraints, conſiderably leſſened.

They are uſually taken with wooden tongs, by the end of the tail, which may be done without danger; for, while held in that poſition, they are unable to wind themſelves up to hurt

their enemy: yet, notwithſtanding this precaution, the viper-catchers are frequently bit by them; but, by the application of olive-oil, the bite is effectually cured.

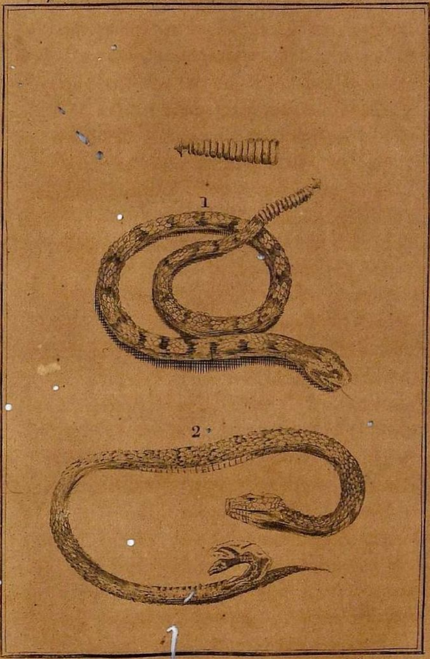
One William Oliver, a viper-catcher at Bath, was the firſt who diſcovered this admirable remedy. On the firſt of June, 1735, in the preſence of a great number of perſons, he ſuffered himſelf to be bit by an old black viper, brought by one of the company, upon the wriſt, and joint of the thumb of the right hand, ſo that drops of blood came out of the wounds: he immediately felt a violent pain both at the top of his thumb, and up his arm, even before the viper was looſened from his hand; ſoon after he felt a pain, reſembling that of burning, trickle up his arm; in a few minutes his eyes began to look red and fiery, and to water much; in leſs than an hour he perceived the venom ſeize his heart, with a pricking pain, which was attended with faintneſs, ſhortneſs of breath, and cold ſweats; in a few minutes after this, his belly began to ſwell, with great gripings, and pains in his back, which were attended with vomitings and purgings: during the violence of theſe ſymptoms, his ſight was gone for ſeveral minutes, but he could hear all the while. He ſaid, that in his former experiments, he had never de-

ferred making uſe of his remedy longer than he perceived the effects of the venom reaching his heart; But this time, being willing to ſatisfy the company thoroughly, and truſting to the ſpeedy effects of his remedy, which was nothing more than olive-oil, he forbore to apply any thing, till he found himſelf exceeding ill and quite giddy. About an hour and a quarter after the firſt of his being bit, a chaffing-diſh of glowing charcoal was brought in, and his naked arm was held over it, as near as he could bear, while his wife rubbed in the oil with her hand, turning his arm continually round, as if ſhe would have roaſted it over the coals: he ſaid the poiſon ſoon abated, but the ſwelling did not diminiſh much. Moſt violent purgings and vomitings ſoon enſued; and his pulſe became ſo low, and ſo often interrupted, that it was thought proper to order him a repetition of cordial potions: he ſaid he was not ſenſible of any great relief from theſe; but that a glaſs or two of olive-oil drank down, ſeemed to give him eaſe. Continuing in this dangerous condition, he was put to bed, where his arm was again bathed over a pan of charcoal, and rubbed with olive-oil, heated in a ladle over the charcoal, by Dr. Mortimer's direction, who was the phyſician that drew up the account. From

this laſt operation he declared that he found immediate eaſe, as though by ſome charm: he ſoon after fell into a profound ſleep, and, after about nine hours ſound reſt, awaked about ſix the next morning, and found himſelf very well; but in the afternoon, on drinking ſome rum and ſtrong beer, ſo as to be almoſt intoxicated, the ſwelling returned, with much pain and cold ſweats, which abated ſoon, on bathing the arm, as before, and wrapping it up in a brown paper, ſoaked in the oil.

Such are the effects of the viper's bite; yet its fleſh has long been celebrated as a noble medicine. A broth, made by boiling one viper in a quart of water till it comes to a pint, is the uſual method in which it is given at preſent; and it is ſaid to be a very powerful reſtorative in battered conſtitutions: the ſalt of vipers is alſo thought to exceed any other animal ſalt whatever, in giving vigour to the languid circulation, and prompting to venery.

The Rattle-ſnake is bred in America, and in no part of the old world. Some are as thick as a man's leg, and ſix feet in length; but the moſt uſual ſize is from four to five feet long. In moſt particulars it reſembles the viper: like that animal, having a large head and a ſmall neck, being of a duſky colour, and furniſhed with



E. Martin sculp.

1. The Rattle Snake.
2. The Female Viper.

with fangs that inflict the most terrible wounds. It differs, however, in having a large scale, which hangs like a penthouse over each eye. The eye also is furnished with a nictitating membrane, that preserves it from dust; and its scales are of a considerable degree of hardness. They are of an orange, tawny, and blackish colour on the back; and of an ash-colour on the belly, inclining to lead. The male may be readily distinguished from the female, by a black velvet spot on the head, and by the head being smaller and longer. But that which besides their superior malignity, distinguishes them from all other animals, is their rattle, an instrument lodged in their tail, by which they make such a loud, rattling noise, when they move, that their approach may readily be perceived, and the danger avoided. This rattle, which is placed in the tail, somewhat resembles, when taken out of the body, the curb chain of a bridle: it is composed of several thin, hard, hollow bones, linked to each other, and rattling upon the slightest motion. It is supposed by some, that the snake acquires an additional bone every year; and that, from hence, its age may be precisely known: however this may be, certain it is, that the young snakes, of a year or two old, have no rattles at all; while many old ones have

been killed, that had from eleven to thirteen joints each. They ſhake and make a noiſe with theſe rattles with prodigious quickneſs when they are diſturbed; however, the peccary and the vulture are no way terrified at the ſound, but haſten, at the ſignal, to ſeize the ſnake, as their moſt favourite prey.

It is very different with almoſt every other animal. The certain death which enſues from this terrible creature's bite, makes a ſolitude wherever it is heard. It moves along with the moſt majeſtic rapidity; neither ſeeking to offend the larger animals, nor fearing their inſults. If unprovoked, it never meddles with any thing but its natural prey; but when accidentally trod upon, or purſued to be deſtroyed, it then makes a dreadful and deſperate defence. It erects itſelf upon its tail, throws back the head, and inflicts its wound in a moment; then parts, and inflicts a ſecond wound: after which, we are told, by ſome, that it remains torpid and inactive, without even attempting to eſcape.

The very inſtant the wound is inflicted, though ſmall in itſelf, it appears more painful than the ſting of a bee. This pain, which is ſo ſuddenly felt, far from abating, grows every moment more excruciating and dangerous: the limb ſwells; the venom reaches the head, which

is ſoon of a monſtrous ſize; the eyes are red and fiery; the heart beats quick, with frequent interruptions: the pain becomes inſupportable, and ſome expire under it in five or ſix hours; but others, who are of ſtronger conſtitutions, ſurvive the agony for a few hours longer, only to ſink under a general mortification, which enſues, and corrupts the whole body.

As a gentleman in Virginia was walking in the fields for his amuſement, he accidentally trod upon a rattle ſnake, that had been lurking in a ſtony place; which, enraged by the preſſure, reared up, bit his hand, and ſhook its rattles. The gentleman readily perceived that he was in the moſt dreadful danger; but unwilling to die unrevenged, he killed the ſnake, and carrying it home in his hand, threw it on the ground before his family, crying out, I am killed, and there is my murderer! In ſuch an extremity, the ſpeedieſt remedies were the beſt. His arm, which was beginning to ſwell, was tied up near the ſhoulder, the wound was anointed with oil, and every precaution taken to ſtop the infection. By the help of a very ſtrong conſtitution he recovered; but not without feeling the moſt various and dreadful ſymptoms for ſeveral weeks together. His arm, below the ligature, appeared of ſeveral colours, with a writhing among

the muſcles, that, to his terrified imagination, appeared like the motions of the animal that had wounded him. A fever enſued; the loſs of his hair, giddineſs, drought, weakneſs, and nervous faintings: till, by ſlow degrees, a very ſtrong habit overpowered the latent malignity of the poiſon.

Several remedies have been tried to alleviate this calamity. A decoction of the Virginian ſnake-root is conſidered as the moſt effectual; and at the ſame time the head of the animal bruiſed and laid upon the part affected, is thought to aſſiſt the cure. In general, however, it is found to be fatal; and the Indians, ſenſible of this, take care to dip their arrows in the poiſon under the rattle-ſnake's fangs, when they deſire to take a ſignal revenge of their enemies..

Thus much concerning this animal is agreed upon by every naturaliſt: there are other circumſtances in its hiſtory, which are not ſo well aſcertained. And firſt, its motion, which ſome deſcribe as the ſwifteſt imaginable; aſſerting, that its Indian name of Ecacoalt, which ſignifies the wind-ſerpent, implies its agility: others, on the contrary, aſſert, that it is the ſloweſt and the moſt ſluggiſh of all ſerpents; and that it ſeldom moves from one place. In this oppo-

fition of opinions, there are others, who affert, that on even ground it moves but flowly; but when, among rocks, that it goes at a great rate. If we may argue from analogy, the opinion of thofe who contend for its flow motion, feems the moft probable; as the viper, which it fo very much refembles, is remarkable among ferpents for its inactivity.

It is faid alfo by fome, that the rattle-fnake has a power of charming its prey into its mouth; and this is as ftrongly contradicted by others. The inhabitants of Penfylvania are faid to have opportunities of obferving this ftrange fafcination every day. The fnake is often feen bafking at the foot of a tree, where birds and fquirrels make their refidence. There, coiled upon its tail, its jaws extended, and its eyes fhining like fire, the rattle-fnake levels its dreadful glare upon one of the little animals above. The bird or the fquirrel, which ever it may be, too plainly perceives the mifchief meditating againft it, and hops from branch to branch, with a timorous, plaintive found, wifhing to avoid, yet incapable of breaking through the fafcination: thus it continues for fome time its feeble efforts and complaints, but is ftill feen approaching lower and lower towards the bottom branches of the tree, until, at laft, as if

overcome by the potency of its fears, it jumps down from the tree directly into the throat of its frightful destroyer.

In order to ascertain the truth of this story, a mouse was put into a large iron cage, where a rattle-snake was kept, and the effect carefully observed. The mouse remained motionless at one end of the cage; while the snake, at the other, continued fixed, with its eye glaring full on the little animal, and its jaws opened to their widest extent: the mouse for some time seemed eager to escape; but every effort only served to encrease its terrors, and to draw it still nearer the enemy; till, after several ineffectual attempts to break the fascination, it was seen to run into the jaws of the rattle-snake, where it was instantly killed.

To these accounts the incredulous oppose the improbability of the fact; they assert, that such a power ascribed to serpents, is only the remnant of a vulgar error, by which it was supposed that serpents could be charmed, and had also a power of charming. They aver, that animals are so far from running down the throat of a rattle-snake in captivity, that the snake will eat nothing in that state, but actually dies for want of subsistence.

A serpent, called the Whip-snake, is still

more venomous than the former. This animal, which is a native of the Eaſt, is about five feet long, yet not much thicker than the thong of a coachman's whip. It is exceedingly venomous; and its bite is ſaid to kill in about ſix hours. One of the Jeſuit miſſionaries, happening to enter into an Indian pagoda, ſaw what he took to be a whip-cord lying on the floor, and ſtooped to take it up; but, upon handling it, what was his ſurprize to find that it was animated, and no other than the whip-ſnake, of which he had heard ſuch formidable accounts: fortune, however, ſeemed favourable to him, for he graſped it by the head, ſo that it had no power to bite him, and only twiſted its folds up his arm. In this manner he held it, till it was killed by thoſe who came to his aſſiſtance.

To this formidable claſs might be added the Aſp, whoſe bite however is not attended with thoſe drowſy ſymptoms which the ancients aſcribed to it. The Jaculus of Jamaica alſo, is one of the ſwifteſt of the ſerpent kind. The Hæmorrhois, ſo called from the hæmorrhages which its bite is ſaid to produce; the Seps, whoſe wound is very venomous, and cauſes the part affected to corrupt in a very ſhort time; the Coral Serpent, which is red, and whoſe bite is ſaid to be fatal. But of all others, the Cobra

di Capello, or Hooded Serpent, inflicts the most deadly and incurable wounds. Of this formidable creature there are five or six different kinds; but they are all equally dangerous, and their bite followed by speedy and certain death. It is from three to eight feet long, with two large fangs hanging out of the upper jaw. It has a broad neck, and a mark of dark brown on the forehead; which, when viewed frontwise, looks like a pair of spectacles; but behind, like the head of a cat. The eyes are fierce, and full of fire; the head is small, and the nose flat, though covered with very large scales, of a yellowish ash-colour; the skin is white, and the large tumour on the neck is flat, and covered with oblong, smooth scales. The bite of this animal is said to be incurable, the patient dying in about an hour after the wound; the whole frame being dissolved into one putrid mass of corruption.

To remedy the bite of all these animals, perhaps sallad oil would be very efficacious: however, the Indians make use of a composition, which is called, in Europe, Petro de Cobra, or the Serpent Stone; and which, applied to the wound, is said to draw out the venom. The composition of this stone, for it is an artificial substance, is kept a secret; and perhaps its

effects in extracting the venom may be imaginary: neverthelefs, it is certain that it has a power of fticking to the fkin, and fucking a part of the blood from the wound. This it may do fomewhat in the fame manner as we fee a tobacco-pipe ftick to the lips of a man who is fmoking: yet ftill we are ignorant of the manner; and the fecret might probably be of fome ufe in medicine. It were to be wifhed, therefore, that thofe who go into India would examine into this compofition, and give us the refult of their enquiries: but I fear that it is not to benefit mankind, that our travellers now go to India.

CHAP.

CHAP. X.

Of Serpents without Venom.

THE class of serpents without poison, may he distinguished from those that are venomous, by their wanting the fang teeth: their heads also are not so thick in proportion to their bodies; and, in general, they taper off to the tail more gradually in a point. But notwithstanding their being destitute of venom, they do not cease to be formidable: some grow to a size by which they become the most powerful animals of the forest; and even the smallest and most harmless of this slender tribe, find protection from the similitude of their form.

The fangs make the great distinction among serpents; and all this tribe are without them. Their teeth are short, numerous, and, in the smaller kinds, perfectly inoffensive: they lie in either jaw, as in frogs and fishes, their points bending backwards, the better to secure their prey. They want that artificial mechanism by which the poisonous tribe inflict such deadly wounds: they have no gland in the head for preparing venom; no conduits for conveying it to the teeth; no receptacles there; no hollow

in the inſtrument that inflicts the wound. Their bite, when the teeth happen to be large enough to penetrate the ſkin, for in general they are too ſmall for this purpoſe, is attended with no other ſymptoms than thoſe of an ordinary puncture; and many of this tribe, as if ſenſible of their own impotence, cannot be provoked to bite, though never ſo rudely aſſaulted. They hiſs, dart out their forky tongues, erect themſelves on the tail, and call up all their terrors to intimidate their aggreſſors; but ſeem to conſider their teeth as unneceſſary inſtruments of defence, and never attempt to uſe them. Even among the largeſt of this kind, the teeth are never employed, in the moſt deſperate engagements. When a hare or a bird is caught, the teeth may ſerve to prevent ſuch ſmall game from eſcaping; but when a buffalo or a tiger is to be encountered, it is by the ſtrong folds of the body, by the fierce verberations of the tail, that the enemy is deſtroyed: by this twining round, and drawing the knot with convulſive energy, this enormous reptile breaks every bone in the quadrupede's body, and then, at one morſel, devours its prey.

From hence we may diſtinguiſh the unvenomous tribe into two kinds; firſt, into thoſe which are ſeldom found of any conſiderable

magnitude, and that never offend animals larger or more powerful than themſelves, but which find their chief protection in flight, or in the doubtfulneſs of their form; ſecondly, into ſuch as grow to an enormous ſize, fear no enemy, but indiſcriminately attack all other animals and devour them. Of the firſt kind is the Common Black Snake, the Blind Worm, the Eſculapian Serpent, the Amphiſbæna, and ſeveral others. Of the ſecond, the Lyboya, the Boiguacu, the Depona, and the Boiquatrara.

The Black Snake is the largeſt of Engliſh ſerpents, ſometimes exceeding four feet in length. The neck is ſlender; the middle of the body thick; the back and ſides covered with ſmall ſcales; the belly with oblong, narrow, tranſverſe plates: the colour of the back and ſides are of a duſky brown; the middle of the back marked with two rows of ſmall black ſpots, running from the head to the tail; the plates on the belly are duſky; the ſcales on the ſides are of a bluiſh white: the teeth are ſmall and ſerrated, lying on each ſide of the jaw in two rows. The whole ſpecies is perfectly inoffenſive; taking ſhelter in dung-hills, and among buſhes in moiſt places; from whence they ſeldom remove, unleſs in the midſt of the day, in ſummer, when they are called out by the heat to baſk themſelves

in the ſun. If diſturbed or attacked, they move away among the brambles with great ſwiftneſs; but if too cloſely purſued, they hiſs and threaten, and thus render themſelves formidable, though incapable of offending.

The black ſnake preys upon frogs, inſects, worms, mice, and young birds; and, conſidering the ſmallneſs of the neck, it is amazing how large an animal it will ſwallow. The black ſnake of Virginia, which is larger than our's, and generally grows to ſix feet long, takes a prey proportionable to its ſize; partridges, chickens, and young ducks. It is generally found in the neighbourhood of the hen rooſt, and will devour the eggs even while the hen is ſitting upon them: theſe it ſwallows whole; and often, after it has done the miſchief, will coil itſelf round in the neſt.

The whole of this tribe are oviparous, excluding eighty or an hundred eggs at a time, which are laid in dung-hills or hot-beds; the heat of which, aided by that of the ſun, brings them to maturity. During winter they lie torpid, in banks of hedges, and under old trees.

The Blind Worm is another harmleſs reptile, with a formidable appearance. The uſual length of this ſpecies is eleven inches. The eyes are red; the head ſmall; the neck ſtill more ſlender;

from that part the body grows ſuddenly, and continues of an equal bulk to the tail, which ends quite blunt: the colour of the back is cinereous, marked with very ſmall lines, compoſed of minute black ſpecks; the ſides are of a reddiſh caſt; the belly duſky, and marked like the back. The motion of this ſerpent is ſlow; from which, and from the ſmallneſs of the eyes, are derived its names; ſome calling it the Slow, and ſome the Blind Worm. Like all the reſt of the kind in our climates, they lie torpid during winter; and are ſometimes found, in vaſt numbers, twiſted together. This animal, like the former, is perfectly innocent; however, like the viper, it brings forth its young alive. Geſner tells us, that one of theſe being ſtruck on the head when it was pregnant, it immediately caſt forth its young.

The Amphiſbæna, or the Double Headed Serpent, is remarkable for moving along with either the head or the tail foremoſt; and from thence it has been thought to have two heads. This error took its riſe from the thickneſs of the tail, which, at a diſtance, may be miſtaken for another head. Upon a nearer view, however, the error is eaſily diſcovered, and the animal will be found formed according to the uſual courſe of nature. It is as thick at one end as

at the other; and the colour of the ſkin is like that of the earth, being rough, hard, and variouſly ſpotted. Some have affirmed that its bite is dangerous; but this muſt be a miſtake, as it wants the fangs, and conſequently the elaboratory that prepares the poiſon.

Theſe animals are only formidable from their ſimilitude to the viper tribe; and, in ſome countries, where ſuch reptiles are common, they make the diſtinction ſo exactly, that while they deſtroy ſerpents of one kind with great animoſity, they take others into their houſes, and even into their boſoms, with a kind of unaccountable affection. The Eſculapian Serpent of Italy is among this number. It is there ſuffered to crawl about the chambers; and often gets into the beds where people lie. It is a yellow ſerpent, of about an ell long; and though innocent, yet will bite when exaſperated. They are ſaid to be great deſtroyers of mice; and this may be the reaſon why they are taken under human protection. The Boyuna of Ceylon is equally a favourite among the natives; and they conſider the meeting it as a ſign of good luck. The Surinam Serpent, which ſome improperly call the Ammodytes, is equally harmleſs and deſireable among the ſavages of that part of the world. They conſider themſelves as extremely

happy if this animal comes into their huts. The colours of this ſerpent are ſo many and beautiful, that they ſurpaſs all deſcription; and theſe perhaps are the chief inducements to the ſavages to conſider its viſits as ſo very fortunate. A ſtill greater favourite is the Prince of Serpents, a native of Japan, that has not its equal for beauty. The ſcales which cover the back are reddiſh, finely ſhaded, and marbled with large ſpots of irregular figures mixed with black. The fore part of the head is covered with large beautiful ſcales, the jaws bordered with yellow, the forehead marked with a black marbled ſtreak, and the eyes handſome and lively. But of all others, the Gerenda of the Eaſt Indies is the moſt honoured and eſteemed. To this animal, which is finely ſpotted with various colours, the natives of Calicut pay divine honours; and while their deity lies coiled up, which is its uſual poſture, the people fall upon their faces before it with ſtupid adoration. The African Gerenda is larger, and worſhipped in the ſame manner, by the inhabitants of the coaſts of Mozambique. The ſkin is not ſo finely ſpotted as the former; but it is variegated all over the body with very fine white, aſh-coloured, and black ſpots. The brilliancy of colouring in theſe reptiles would only ſerve with us to encreaſe our diſguſt; but in

in thofe countries where they are, common diftinctions are made; and even in this horrid clafs, there are fome eyes that can difcover beauty.

But in the larger tribe of ferpents, there is nothing but danger to be apprehended. This formidable clafs, though without venom, have fomething frightful in their colour, as well as their fize and form. They want that vivid hue with which the favages are fo much pleafed in the leffer kinds; they are all found of a dufky colour, with large teeth, which are more formidable than dangerous.

The firft of this clafs, is the Great Jiboya of Java and Brazil, which Legaut affirms, he has feen fifty feet long. Nor is he fingular in this report, as many of the miffionaries affirm the fame; and we have the concurrent teftimony of hiftorians as a further proof. The largeft animal of this kind, which has been brought into Europe, is but thirty-fix feet long; and it is probable, that much greater have been feen and deftroyed, before they were thought worth fending fo far, to fatisfy European curiofity. The moft ufual length, however of the jiboya, is about twenty feet, and the thicknefs in proportion. The teeth are fmall in proportion to

the body; nor are they uſed, but when it ſeizes the ſmalleſt prey. It lies in wait for wild animals near the path, and when it throws itſelf upon them, it wraps them round ſo cloſely as to break all the bones; then moiſtening the whole body over with its ſlaver, it makes it fit for deglutition, and ſwallows it whole.

The Boiguacu is ſuppoſed to be the next in magnitude, and has often been ſeen to ſwallow a goat whole. It is thickeſt in the middle of the body, and grows ſhorter and ſmaller towards the head and the tail: on the middle of the back, there is a chain of ſmall black ſpots running along the length of it; and on each ſide, there are large round black ſpots, at ſome diſtance from each other, which are white in the center: between theſe, near the belly, there are two rows of leſſer black ſpots, which run parallel to the back. It has a double row of ſharp teeth in each jaw, of a white colour, and ſhining like mother-of-pearl. The head is broad; and over the eyes it is raiſed into two prominences: near the extremity of the tail there are two claws, reſembling thoſe of birds.

Theſe ſerpents lie hid in thickets, from whence they ſally out unawares, and raiſing themſelves upright on their tails, will attack both men and

beafts. They make a loud hiffing noife when exafperated; and fometimes winding up trees, will dart down upon travellers, and twift themfelves fo clofely round their bodies, as to difpatch them in a very few minutes. Condamine, however, affirms, that their bite is not dangerous; for though the teeth are fo large as to infpire the beholder with terror, yet the wound they make is attended with no dangerous confequences whatever. Dellon affirms, that they generally haunt defert places; and though they are fometimes feen near great towns, or on the banks of rivers, yet it is generally after fome great inundation: he never faw any but what were dead; and they appeared to him, like the trunk of a great tree lying on the ground.

To this clafs of large ferpents, we may refer the Depona, a native of Mexico, with a very large head and great jaws. The mouth is armed with cutting, crooked teeth, among which there are two longer than the reft, placed in the fore part of the upper jaw, but very different from the fangs of the viper. All round the mouth there is a broad fcaly border; and the eyes are fo large, that they give it a very terrible afpect. The forehead is covered with very large fcales;

on which are placed others, that are ſmaller, curiouſly ranged: thoſe on the back are greyiſh, and along it runs a double chain, whoſe ends are joined in the manner of a buckler. Each ſide of the belly is marbled with large ſquare ſpots, of a cheſnut colour; in the middle of which is a ſpot, which is round and yellow. They avoid the ſight of man; and conſequently, never do much harm.

Such are the moſt noted animals of the ſerpent tribe: but to recount all, would be a vain, as well as a uſeleſs endeavour. In thoſe countries where they abound, their diſcriminations are ſo numerous, and their colours ſo various, that every thicket ſeems to produce a new animal. The ſame ſerpent is often found to bring forth animals of eight or ten different colours: and the naturaliſt who attempts to arrange them by that mark, will find that he has made diſtinctions which are entirely diſowned by Nature: however, a very conſiderable number might be added to enlarge the catalogue; but having ſupplied a general hiſtory, the mind turns away from a ſubject where every object preſents ſomething formidable or loathſome to the imagination. Indeed, the whole tribe reſemble each other ſo nearly, that the hiſtory of one

may almoſt ſerve for every other. They are all terrible to the imagination, all frightful to behold in their fury, and have long been conſidered as a race of animals between whom and man there is a natural antipathy.

AN

HISTORY

OF

INSECTS.

PART I.

AN

HISTORY

OF

INSECTS.

CHAP. I.

Of Insects in general.

HAVING gone through the upper ranks of nature, we descend to that of insects, a subject almost inexhaustible from the number of its tribes and the variety of their appearance. Those who have professedly written on this subject seem to consider it as one of the greatest that can occupy the human mind, as the most pleasing in animated nature. "After an "attentive examination," says Swammerdam, "of the nature and anatomy of the smallest as "well as the largest animals, I cannot help al-"lowing the least an equal, or perhaps a su-"perior, degree of dignity. If, while we dissect "with care the larger animals, we are filled

"with wonder at the elegant difpofition of "their parts, to what an height is our aftonifh-"ment raifed, when we difcover all thefe parts "arranged in the leaft in the fame regular "manner! Notwithftanding the fmallnefs of "ants, nothing hinders our preferring them "to the largeft animals; if we confider either "their unwearied diligence, their wonderful "ftrength, or their inimitable propenfity to "labour. Their amazing love to their young "is ftill more unparalleled among the larger "claffes. They not only daily carry them to "fuch places as may afford them food; but if "by accident they are killed, and even cut into "pieces, they, with the utmoft tendernefs, will "carry them away piecemeal in their arms. "Who can fhew fuch an example among the "larger animals, which are dignified with the "title of perfect? Who can find an inftance in "any other creature that can come in compe-"tition with this?"

Such is the language of a man who by long ftudy became enamoured of his fubject; but to thofe who judge lefs partially, it will be found that the infect tribe, for every reafon, deferve but the laft and loweft rank in animated nature. As in mechanics the moft complicated machines are required to perform the niceft operations, fo in

anatomy the nobleſt animals are moſt variouſly and wonderfully made. Of all living beings, man offers the moſt wonderful variety in his internal conformation; quadrupedes come next; and other animals follow in proportion to their powers or their excellencies. Inſects ſeem of all others the moſt imperfectly formed: from their minuteneſs, the diſſecting knife can go but a ſhort way in the inveſtigation; but one thing argues an evident imperfection, which is, that many of them can live a long time, though deprived of thoſe organs which are neceſſary to life in the higher ranks of nature. Many of them are furniſhed with lungs and a heart like nobler animals; yet the caterpillar continues to live, though its heart and lungs, which is often the caſe, are entirely eaten away.

But it is not from their conformation alone that inſects are inferior to other animals, but from their inſtincts alſo. It is true, that the ant and the bee preſent us with very ſtriking inſtances of aſſiduity; but how far are theirs beneath the marks of ſagacity exhibited in the hound or the ſtag! A bee taken from the ſwarm is totally helpleſs and inactive, incapable of giving the ſmalleſt variation to its inſtincts: it has but one ſingle method of operating; and, if put from that, it can turn to

no other. In the purſuits of the hound, there is ſomething like a choice; in the labours of the bee, the whole appears like neceſſity or compulſion.

If inſects be conſidered as bearing a relation to man, and as aſſiſting him in the pleaſures or neceſſities of life, they will, even in this reſpect, ſink in the compariſon with the larger tribes of nature. It is true, that the bee, the ſilk-worm, the cochineal fly, and the cantharides, render him ſignal ſervices; but how many others of this claſs, are either noxious, or totally unſerviceable to him. Even in a country like ours, where all the noxious animals have been reduced by repeated aſſiduity, the inſect tribes ſtill maintain their ground, and are but too often unwelcome intruders upon the fruits of human induſtry. But in more uncultivated regions, their annoyance and devaſtations are terrible. What an uncomfortable life muſt the natives lead in Lapland, and ſome parts of America, where, if a candle be lighted, the in-ſects ſwarm in ſuch abundance, as inſtantly to extinguiſh it with their numbers; where the in-habitants are obliged to ſmear their bodies and faces with tar, or ſome other compoſition, to protect them from the puncture of their minute enemies; where, though millions are deſtroyed,

famiſhed millions are ſtill ſeen to ſucceed, and to make the torture endleſs!

Their amazing number is alſo an argument of their imperfection. It is a rule that obtains through all nature, that the nobler animals are ſlowly produced, and that nature acts with a kind of dignified economy; but the meaner births are laviſhed in profuſion, and thouſands are brought forth merely to ſupply the neceſſities of the more favourite objects of creation. Of all other productions in nature, inſects are the moſt numerous. Vegetables that cover the ſurface of the earth bear no proportion to their multitudes; and though at firſt ſight herbs of the field ſeem to be the parts of organized nature produced in the greateſt abundance, yet, upon minuter inſpection, we ſhall find every plant ſupporting a number of ſcarce perceptible creatures, that fill up the various ſtages of youth, vigour, and age, in the compaſs of a few day's exiſtence.

All other animals are capable of ſome degree of education; their inſtincts may be ſuppreſſed or altered; the dog may be taught to fetch and carry; the bird to whiſtle a tune; and the ſerpent to dance: but the inſect has but one invariable method of operating; no arts can turn it from its inſtincts; and indeed its life is too

ſhort for inſtruction, as a ſingle ſeaſon often terminates its exiſtenee.

For theſe reaſons, the inſect tribe are deſervedly placed in the loweſt rank of animated nature; and, in general, they ſeem more allied to the vegetables on which they feed than to the nobler claſſes above them. Many of them are attached to one vegetable, often to a ſingle leaf; there they encreaſe with the flouriſhing plant, and die as it decays; a few days fill up the meaſure of their contemptible lives; while the ends for which they were produced, or the pleaſures they enjoyed, to us at leaſt, are utterly unknown.

Yet while I am thus fixing the rank of a certain claſs of animals, it ſeems neceſſary to define the nature of thoſe animals which are thus degraded. Definitions in general produce little knowledge; but here where the ſhades of nature are ſo intimately blended, ſome diſcrimination is neceſſary to prevent confuſion. The ſmallneſs of the animal, for inſtance, does not conſtitute an inſect; for then, many of the lizard kind, which are not above two inches long, would come under this denomination; and if the ſmaller lizards, why not the crocodile, which would be a terrible inſect indeed? In the ſame manner, ſmallneſs, with a ſlow creeping

motion, does not conftitute an infect; for, though fnails might be called infects with the fame propriety, the whole tribe of fea fhell-fifh would then have equal pretenfions, and a very troublefome innovation would be brought into our language, which is already formed. Excluding fuch animals, therefore, from the infect tribe, we may define infects to be *little animals without red blood, bones or cartilages, furnifhed with a trunk, or elfe a mouth, opening lengthwife, with eyes which they are incapable of covering, and with lungs which have their openings on the fides.* This definition comprehends the whole clafs of infects, whether with or without wings, whether in their caterpillar or butterfly ftate, whether produced in the ordinary method of generation between male and female, or from an animal that is itfelf both male and female, or from the fame animal cut into feveral parts, and each part producing a perfect animal.

From hence it appears, that in this clafs of animals there are numerous diftinctions, and that a general defcription will by no means ferve for all. Almoft every fpecies has its own diftinct hiftory; and exhibits manners, appetites, and modes of propagation, peculiarly its own. In the larger ranks of exiftence, two animals that nearly refemble each other in form will be

found to have a ſimilar hiſtory; but here inſects almoſt entirely alike will be often found perfectly diſſimilar, as well in their manner of bringing forth and ſubſiſting as in the changes which they undergo during their ſhort lives. Thus as this claſs is prolific beyond computation, ſo are its varieties multiplied beyond the power of deſcription. The attempt to enumerate all the ſpecies of a fly or a moth would be very fruitleſs; but to give an hiſtory of all would be utterly impracticable; ſo various are the appetites, the manners, and the lives of this humble claſs of beings, that every ſpecies requires its diſtinct hiſtory. An exact plan, therefore, of Nature's operations in this minute ſet of creatures is not to be expected; and yet ſuch a general picture may be given, as is ſufficient to ſhew the protection which Providence affords its ſmalleſt as well as its largeſt productions, and to diſplay that admirable circulation in nature, by which one ſet of living beings find ſubſiſtence from the deſtruction of another; and by which life is continued without a pauſe in every part of the creation.

Upon caſting a ſlight view over the whole inſect tribe juſt when they are ſuppoſed to rouze from their ſtate of annual torpidity, when they begin to feel the genial influence of ſpring, and again exhibit new life in every part of nature,

their numbers and their varieties ſeem to exceed all powers of calculation, and they are indeed too great for deſcription. When we look cloſer, however, we ſhall find ſome ſtriking ſimilitudes, either in their propagation, their manners, or their form, that give us a hint for grouping ſeveral of them into one deſcription, and thus enabling us to ſhorten the labour of a ſeparate hiſtory for every ſpecies. Swammerdam, Reaumur, and Linnæus, have each attempted to abridge the taſk of deſcription, by throwing a number of ſimilar animals into diſtinct claſſes, and thus making one general hiſtory ſtand for all. I will avail myſelf of their labours; and uniting their general diſtinctions, throw the whole claſs of inſects into four ſeparate diſtributions, giving under each the hiſtory of every ſpecies that ſeems to me conſiderable enough to deſerve our notice. Thus our labour will be ſhortened; and the very rank in which an inſect is placed will, in ſome meaſure, exhibit a conſiderable part of its hiſtory.

In our curſory inſpection of the inſect tribe, the firſt animals that offer themſelves are thoſe which want wings, that appear crawling about on every plant, and on every ſpot of earth we regard with any degree of attention. Of theſe, ſome never obtain wings at any period of their

existence, but are destined to creep on the vegetable, or the spot of earth where they are stationed, for their whole lives. On the contrary, others are only candidates for a more happy situation; and only wait their growing wings, when they may be said to arrive at their state of full perfection.

Those that never have wings, but creep about till they die, may be considered as constituting the *first* class of insects. All these, the flea and the wood-louse only excepted, are produced from an egg; and when once they break the shell, they never suffer any further change of form, but continue to grow larger till they die. Thus the louse or the spider are produced from an egg, never suffering any alteration when once they are excluded; but, like the chicken or the duck, remaining invariably the same, from their birth to their dissolution.

The second order of insects consists of such as have wings; but which, when produced from the egg, have those wings cased up in such a manner as not to appear. This casing up of the wing, however, does not prevent the animal's running, leaping, and moving with its natural celerity; but when the case bursts, and the wings have a power of expanding, all

the animal's motions become more extenſive, and the animal arrives at full perfection. Thus the graſshopper, the dragon fly, and the ear-wig, have their wings at firſt bound down; but when the ſkin that, like a pair of ſtays, kept them confined, burſts, they are then expanded, and the animal purſues the purpoſes for which it was produced.

The third order of inſects is of the moth and butterfly kind. Theſe all have four wings, each covered with a mealy ſubſtance of various colours, which when handled comes off upon the fingers; and, if examined by the microſcope, will appear like ſcales, with which the wing is nicely embroidered all over. Theſe inſects alſo are produced in a manner peculiar to themſelves. They are firſt hatched from an egg, from whence proceeds a caterpillar that eats, and often caſts its ſkin; the caterpillar having diveſted itſelf for the laſt time, aſſumes a new covering, which is called a chryſalis, or the cone in the ſilk-worm, in which it continues hidden till it comes forth a perfect moth and butterfly.

The fourth order is of thoſe winged inſects which come from a worm inſtead of a caterpillar, and yet go through changes ſimilar to

thofe which moths and butterflies are feen to undergo. They are firft excluded from the egg as a worm, and then become a chryfalis; in fome, their wings and legs are feen; in others, the animal is quite detached from the cone in which it is concealed; but all at length break their prifon, and come out perfect winged animals; fome furnifhed with two wings and fome with four. The wings of all thefe differ from thofe of the butterfly and moth kind, by not having the mealy fcales which are ever found on the wings of the former. In this clafs we may place the numerous tribes of gnats, beetles, bees, and flies.

To thefe I will add, as a fifth order, a numerous tribe lately difcovered, to which naturalifts have given the name of Zoophytes. Thefe do not go through the ordinary forms of generation, but may be propagated by diffection. Some of thefe, though cut into an hundred parts, ftill retain life in each, and are endued with fuch a vivacious principle, that every part will in a fhort time become a perfect animal. They feem a fet of creartures placed between animals and vegetables, and make the fhade that connects animated and infenfible nature. To this clafs belong the polypus, the earthworm, and all the varieties of the fea-nettle.

Having thus given a general diſtribution of inſects, I will proceed to deſcribe each claſs in the order I have mentioned them; beginning with inſects without wings, as they more nearly reſemble the higher ranks of nature, as well in their habits as their conformation.

CHAP. II.

Of Insects without Wings.

EVERY moment's observation furnishes us with instances of insects without wings; but the difficulty is to distinguish those which are condemned continually to lead reptile lives, from such as only wait the happy moment of transmutation. For this, nothing but a long and intimate acquaintance will suffice; but, in general, all animals resembling the flea, the louse, the spider, the bug, the wood-louse, the water-louse, and the scorpion, never acquire wings, but are produced from the egg in that form which they never change afterwards.

If we consider this class as distinct from others, we shall find them in general longer lived than the rest, and often continuing their term beyond one season, which is the ordinary period of an insect's existence. They seem also less subject to the influence of the weather; and often endure the rigours of winter without being numbed into torpidity. The whole race of moths, butterflies, bees, and flies, are rendered lifeless by the return of cold weather; but we need not be told, that the louse, the flea,

and many of thefe winglefs creatures that feem formed to teize mankind, continue their painful depredations the whole year round.

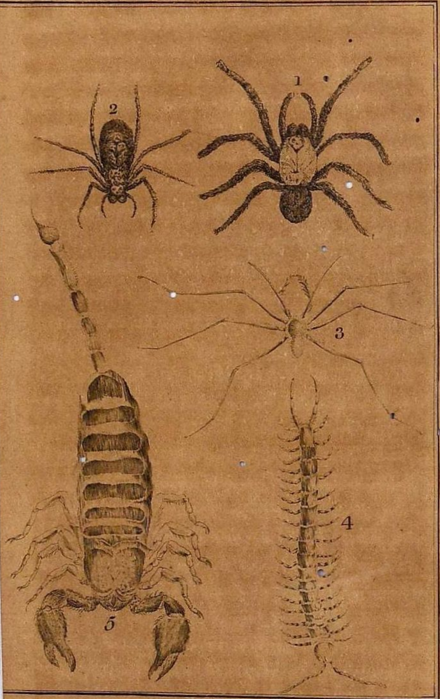
They come to perfection in the egg, as was faid before; and it fometimes happens, that when the animal is interrupted in performing the offices of exclufion, the young ones burft the fhell within the parent's body, and are thus brought forth alive. This not unfrequently happens with the wood-loufe, and others of the kind, which are fometimes feen producing eggs, and fometimes young ones perfectly formed.

Though thefe creatures are perfect from the beginning, yet they are often, during their exiftence, feen to change their fkin: this is a faculty which they poffefs in common with many of the higher ranks of animals, and which anfwers the fame purpofes. However tender their fkins may feem to our feel, yet, if compared to the animal's ftrength and fize, they will be found to refemble a coat of mail or, to talk more clofely, the fhell of a lobfter. By this fkin thefe animals are defended from accidental injuries, and particularly from the attacks of each other, Within this they continue to grow, till their bodies become fo large as to be imprifoned in their own covering, and then the

ſhell burſts, but is quickly replaced by a new one.

Laſtly, theſe animals are endued with a degree of ſtrength for their ſize, that at firſt might exceed credibility.—Had man an equal degree of ſtrength, bulk for bulk, with a louſe or flea, the hiſtory of Samſon would be no longer miraculous.—A flea will draw a chain an hundred times heavier than itſelf; and to compenſate for this force, will eat ten times its own ſize of proviſion in a ſingle day.

CHAP.



C. Martin sculp.

1. 2. 3. Spiders.
4 The Scolopondra.
5. The Scorpion.

CHAP. III.

Of the Spider and its Varieties.

THE animal that deſerves our firſt notice in this principal order of inſects is the ſpider, whoſe manners are of all others the moſt ſubtle, and whoſe inſtincts are moſt various. Formed for a life of rapacity, and incapable of living upon any other than inſect food, all its habits are calculated to deceive and ſurprize; it ſpreads toils to entangle its prey; it is endued with patience to expect its coming; and is poſſeſſed of arms and ſtrength to deſtroy it when fallen into the ſnare.

In this country, where all the inſect tribes are kept under by human aſſiduity, the ſpiders are but ſmall and harmleſs. We are acquainted with few but the houſe-ſpider, which weaves its web in neglected rooms; the garden-ſpider, that ſpreads it toils from tree to tree, and reſts in the center; the wandering-ſpider, that has no abode like the reſt; and the field-ſpider, that is ſometimes ſeen mounting, web and all, into the clouds. Theſe are the chief of our native ſpiders; which, though reputed venomous, are entirely inoffenſive. But they form

a much more terrible tribe in Africa and America. In those regions, where all the insect species acquire their greatest growth, where the butterfly is seen to expand a wing as broad as our sparrow, and the ant to build an habitation as tall as a man, it is not to be wondered at that the spiders are seen bearing a proportionable magnitude. In fact, the bottom of the Martinico spider's body is as large as a hen's egg, and covered all over with hair. Its web is strong, and its bite dangerous. It is happy for us, however, that we are placed at a distance from these formidable creatures, and that we can examine their history without feeling their resentment.

Every spider has two divisions in its body. The fore-part, containing the head and breast, is separated from the hinder part or belly by a very slender thread, through which, however, there is communication from one part to the other. The fore part is covered with a hard shell, as well as the legs, which adhere to the breast. The hinder part is cloathed with a supple skin, beset all over with hair. They have several eyes all round the head, brilliant and acute; these are sometimes eight in number, sometimes but six; two behind, two before, and the rest on each side. Like

all other insects, their eyes are immovable; and they want eylids; but this organ is fortified with a transparent horny substance, which at once secures and assists their vision. As the animal procures its subsistence by the most watchful attention, so large a number of eyes was necessary to give it the earliest information of the capture of its prey. They have two pincers on the fore-part of the head, rough, with strong points, toothed like a saw, and terminating in claws like those of a cat. A little below the point of the claw there is a small hole, through which the animal emits a poison, which, though harmless to us, is sufficiently capable of instantly destroying its prey. This is the most powerful weapon they have against their enemies; they can open or extend these pincers as occasion may require; and when they are undisturbed, they suffer them to lie one upon the other, never opening them but when there is a necessity for their exertion. They have all eight legs, jointed like those of lobsters, and similar also in another respect; for if a leg be torn away, or a joint cut off, a new one will quickly grow in its place, and the animal will find itself fitted for combat as before. At the end of each leg there are three crooked moveable claws; namely, a small one,

placed higher up, like a cock's ſpur, by the aſſiſtance of which it adheres to the threads of its web. There are two others larger, which meet together like a lobſter's claw by which they can catch hold of the ſmalleſt depreſſions, walking up or down the very poliſhed ſurfaces, on which they can find inequalities that are imperceptible to our groſſer ſight. But when they walk upon ſuch bodies as are perfectly ſmooth, as looking glaſs or poliſhed marble, they ſqueeze a little ſponge, which grows near the extremity of their claws, and thus diffuſing a glutinous ſubſtance, adhere to the ſurface until they make a ſecond ſtep. Beſides the eight legs juſt mentioned. theſe animals have two others, which may more properly be called arms, as they do not ſerve to aſſiſt motion, but are uſed in holding and managing their prey.

The ſpider, though thus formidably equipped, would ſeldom prove ſucceſsful in the capture, were it not equally furniſhed with other inſtruments to aſſiſt its depredations. As it lives wholly upon flies, and is without wings to purſue them, it is obvious they muſt for ever eſcape ſo impotent an adverſary; but the ſpider is a moſt experienced hunter, and ſpreads its nets to catch thoſe animals it is unable to purſue. The ſpider's web is generally laid in thoſe

places where flies are moſt apt to come and ſhelter; in the corners of rooms, round the edges of windows, and in the open air among the branches of trees. There the little animal remains for days, nay weeks together, in patient expectation, ſeldom changing its ſituation though never ſo unſucceſsful.

For the purpoſes of making this web, Nature has ſupplied this animal with a large quantity of glutinous matter within its body, and five dugs or teats for ſpinning it into thread. This ſubſtance is contained in a little bag, and at firſt ſight it reſembles ſoft glue; but when examined more accurately, it will be found twiſted into many coils of an agate colour, and upon breaking it, the contents may be eaſily drawn out into threads, from the tenacity of the ſubſtance, not from thoſe threads being already formed. Thoſe who have ſeen the machine by which wire is ſpun, will have an idea of the manner in which this animal forms the threads of its little net, the orifices of the five teats above mentioned, through which the thread is drawn, contracting or dilating at pleaſure. The threads which we ſee, and appear ſo fine, are, notwithſtanding, compoſed of five joined together, and theſe are many times doubled when the web is in formation.

When a house-spider proposes to begin a web, it first makes choice of some commodious spot, where there is an appearance of plunder and security. The animal then distils one little drop of its glutinous liquor which is very tenacious, and then creeping up the wall, and joining its thread as it proceeds, it darts itself in a very surprising manner, as I have often seen, to the opposite place, where the other end of the web is to be fastened. The first thread thus formed, drawn tight, and fixed at each end, the spider then runs upon it backward and forward, still assiduously employed in doubling and strengthening it, as upon its force depends the strength and stability of the whole. The scaffolding thus completed, the spider makes a number of threads parallel to the first, in the same manner, and then crosses them with others; the clammy substance of which they are formed, serving to bind them, when newly made, to each other.

The insect after this operation, doubles and trebles the thread that borders its web, by opening all its teats at once, and secures the edges, so as to prevent the wind from blowing the work away. The edges being thus fortified, the retreat is next to be attended to; and this is formed like a funnel at the bottom

of the web, where the little creature lies concealed. To this are two paſſages, or outlets, one above and the other below, very artfully contrived, to give the animal an opportunity of making excurſions at proper ſeaſons, of prying into every corner, and cleaning thoſe parts which are obſerved to be clogged or encumbered. Still attentive to its web, the ſpider, from time to time, cleans away the duſt that gathers round it, which might otherwiſe clog and incommode it: for this purpoſe, it gives the whole a ſhake with its paws; ſtill, however, proportioning the blow ſo as not to endanger the fabric. It often happens alſo, that from the main web there are ſeveral threads extended at ſome diſtance on every ſide: theſe are, in ſome meaſure, the outworks of the fortification, which, whenever touched from without, the ſpider prepares for attack or ſelf-defence. If the inſect impinging be a fly, it ſprings forward with great agility; if, on the contrary, it be the aſſault of an enemy ſtronger than itſelf, it keeps within its fortreſs, and never ventures out till the danger be over. Another advantage which the ſpider reaps from this contrivance of a cell or retreat behind the web, is, that it ſerves for a place where the creature

can feaſt upon its game with all ſafety, and conceal the fragments of thoſe carcaſſes which it has picked, without expoſing to public view the leaſt trace of barbarity, that might create a ſuſpicion in any inſects that their enemy was near.

It often happens, however, that the wind, or the ruſtling of the branches, or the approach of ſome large animal, deſtroys in a minute the labours of an age. In this caſe, the ſpider is obliged to remain a patient ſpectator of the univerſal ruin; and when the danger is paſſed away, it ſets about repairing the calamity. For this purpoſe, it is furniſhed with a large ſtore of the glutinous ſubſtance of which the web is made; and with this, it either makes a new web; or patches up the old one. In general, however, the animal is much fonder of mending than making, as it is furniſhed originally with but a certain quantity of glutinous matter, which, when exhauſted, nothing can renew. The time ſeldom fails to come, when their reſervoirs are entirely dried up, and the poor animal is left to all the chances of irretrievable neceſſity. An old ſpider is thus frequently reduced to the greateſt extremity; its web is deſtroyed, and it wants the materials

to

to make a new one. But as these animals have been long accustomed to a life of shifting, it hunts about to find out the web of another spider, younger and weaker than itself, with whom it ventures a battle. The invader generally succeeds; the young one is driven out to make a new web, and the old one remains in quiet possession. If, however, the spider is unable to dispossess any other of its web, it then endeavours, for a while, to subsist upon accidental depredation; but in two or three months it inevitably dies of hunger.

The garden-spider seems to work in a different manner. The method with this insect is to spin a great quantity of thread, which floating in the air in various directions, happens from its glutinous quality, at last to stick to some object near it, a lofty plant or the branch of a tree. The spider only wants to have one end of the line fast, in order to secure and tighten the other. It accordingly draws the line when thus fixed, and then by passing and repassing upon it, strengthens the thread in such a manner as to answer all its intentions. The first cord being thus stretched, the spider walks along a part of it, and there fastens another, and dropping from thence, fastens the thread to some solid body below, then climbs

up again and begins a third, which it faſtens by the ſame contrivance. When three threads are thus fixed, it forms a ſquare or ſomething that very nearly reſembles one; and in this the animal is generally ſeen to reſide. It often happens, however, when the young ſpider begins ſpining, that its web becomes too buoyant, and not only the thread floats in the air, but even the little ſpinſter. In this manner we have often ſeen the threads of ſpiders floating in the air; and what is ſtill more ſurpriſing, the young ſpiders themſelves attached to their own web. The reaſon is obvious; for as even gold itſelf may be ſo finely drawn out as to float in the air, ſo the finer thread of a ſpider is ſo buoyant as not only to ſwim in the air, but alſo to lift the ſpider itſelf; which, like the tail of a kite, riſes with its own manufacture.

The ſpider's web being thus completed, and fixed in a proper place, its next care is to ſeize and ſecure whatever inſect happens to be caught in the toil. For this purpoſe, it remains for weeks and even months upon the watch, without ever catching a ſingle fly; for the ſpider, like moſt other inſects, is ſurpriſingly patient of hunger. It ſometimes happens that too ſtrong a fly ſtrikes itſelf againſt the web, and

thus, inſtead of being caught, tears the net to pieces. In general, however, the butterfly or the hornet, when they touch the web, fly off again, and the ſpider ſeems no way diſpoſed to interrupt their retreat. The large blue-bottle-fly, the ichneumon-fly, and the common meat-fly, ſeem to be its favourite game. When one of theſe ſtrike into the toils, the ſpider is inſtantly ſeen alert and watchful at the mouth of its hole, careful to obſerve whether the fly be completely immeſhed. If that be the caſe, the ſpider walks leiſurely forward, ſeizes its prey, and inſtantly kills it by inſtilling a venomous juice into the wound it makes. If, however, the fly be not entirely immeſhed, the ſpider patiently waits, without appearing until its prey has fatigued itſelf by its ſtruggles to obtain its liberty; for if the ravager ſhould appear in all his terrors while the prey is but half involved, a deſperate effort might give it force enough to get free. If the ſpider has faſted for a long time, it then drags the fly immediately into its hole and devours it; but if there has been plenty of game, and the animal be no way preſſed by hunger, it then gives the fly two or three turns in its web, ſo as completely to immeſh it, and there leaves it impotently to ſtruggle until the little tyrant comes to its ap-

petite. Why the ſpider ſhould at one time kill its prey, and at another ſuffer it to ſtruggle in the toils for ſeveral hours together, I am not able to ſay; perhaps it only likes its prey newly killed, and therefore delays to put the captive to death until it is to be eaten.

It has been the opinion of ſome philoſophers, that the ſpider was in itſelf both male and female; but Liſter has been able to diſtinguiſh the ſexes, and to perceive that the males were much leſs in ſize than the females. But this is not the chief peculiarity; for, different from all other animals, except the fiſh called the Ray, it has its inſtruments of generation placed in the fore-arms, which have been already deſcribed. When theſe animals copulate, they for ſome time teize each other with their legs and arms, then appear the inſtruments of generation in the male, as if burſting out from the points of its fore-feet, and are inſerted into the receptacle beneath the body of the female.

The female generally lays from nine hundred to a thouſand eggs in a ſeaſon; they are of a bluiſh colour, ſpeckled with black, and ſeparated from each other by a glutinous ſubſtance, not unlike frog ſpawn water. Theſe eggs are large or ſmall in proportion to the ſize of the animal that produces them. In ſome they are

as large as a grain of muftard-feed; in others, they are fcarcely vifible. The female never begins to lay till fhe be two years old at the leaft, and her firft brood is never fo numerous as when fhe has come to her greateft maturity.

When the number of eggs which the fpider has brought forth have remained for an hour or two to dry after exclufion, the little animal then prepares to make them a bag, where they are to be hatched until they leave the fhell. For this purpofe, fhe fpins a web four or five times ftronger than that made for catching flies; and, befides, lines it within fide by a down, which fhe plucks from her own breaft. This bag, when completed, is as thick as paper, is fmooth within fide, but rougher without. Within this they depofit their eggs; and it is almoft incredible to relate the concern and induftry which they beftow in the prefervation of it. They ftick it by means of their glutinous fluid to the end of their body; fo that the animal, when thus loaded, appears as if fhe had one body placed behind another. If this bag be feparated from her by any accident, fhe employs all her affiduity to ftick it again in its former fituation, and feldom abandons her treafure but with her life. When the young ones are excluded from their fhells, within the

bag, they remain for ſome time in their confinement, until the female, inſtinctively knowing their maturity, bites open their priſon, and ſets them free. But her parental care does not terminate with their excluſion; ſhe receives them upon her back for ſome time, until they have ſtrength to provide for themſelves, when they leave her never to return, and each begin a ſeparate manufactory of its own. The young ones begin to ſpin when they can ſcarcely be diſcerned; and prepare for a life of plunder before they have ſtrength to overcome. Indeed, Nature ſeems to have formed them in every reſpect for a life of hoſtility. No other inſect is poſſeſſed of ſuch various powers of aſſault and defence; and they are able to deſtroy animals ten times bigger than themſelves. Even after a ſevere defeat, they quickly recover of their wounds; and as for their legs, they conſider the loſs of them as but a ſmall misfortune, as they grow again very ſpeedily to their former magnitude.

Thus there is no inſect to which they are not an enemy; but what is more barbarous ſtill, ſpiders are the enemies of each other. Mr. Reaumur, who was fond of making experiments upon inſects, tried to turn the labours of the ſpider to human advantage, and actually

made a pair of gloves from their webs. For this purpose, he collected a large number of those insects together: he took care to have them constantly supplied with flies, and the ends of young feathers, fresh picked from chickens and pigeons, which being full of blood, are a diet that spiders are particularly fond of. But notwithstanding all his care, he was soon convinced that it was impracticable to rear them, since they were of such a malignant nature, that they could never be brought to live in society; but instead of their usual food, chose to devour each other. Indeed, were it practicable to reconcile them to each other, it would require too much attendance to rear up a sufficient number to make the project any way useful. Their thread is four, if not five times finer than that of the silk-worm; so that upon the smallest calculation, there must have been sixty thousand spiders to make a single pound of silk. That which Reaumur made use of, was only the web in which they deposited their eggs, which is five times stronger than their ordinary manufacture.

Of this animal, there are several kinds, slightly differing from each other, either in habits or conformation. The Water-spider is the most remarkable of the number. This insect

resembles the common spider in its appearance, except that its hinder part is made rather in the shape of a nine-pin than a ball. They differ in being able to live as well by land as water; and in being capable of spining as well in one element as the other. Their appearance under water is very remarkable; for though they inhabit the bottom, yet they are never touched by the element in which they reside, but are enclosed in a bubble of air that, like a box, surrounds them on every side. This bubble has the bright appearance, at the bottom, of quicksilver; and within this, they perform their several functions of eating, spinning and sleeping, without its ever bursting, or in the least disturbing their operations: sometimes, the bubble is seen divided into three distinct apartments; and in the spring, the male enters one of those to impregnate the female, in the manner mentioned above, while the bubble in which he was contained unites with the other, like two drops of water, when approached to each other. They spin their webs as well in the water as upon land; and it is most probable that they make their food of the small insects of either element.

The Tarantula is also of this species, and deserves particular notice, not for any remarkable

properties that really attend it, but for the numerous falfehoods which have been propagated concerning it. What may be faid with truth concerning it is, that it is the largeft of the fpider kind known in Europe, and is a native of Apulia in Italy. Its body is three quarters of an inch long, and about as thick as one's little finger; the colour is generally an olive brown, variegated with one that is more dufky; it has eight legs and eight eyes, like the reft, and nippers, which are fharp and ferrated: between thefe and the fore legs, there are two little horns, or feelers, which it is obferved to move very brifkly when it approaches its prey. It is covered all over the body with a foft down; and propagates, as other fpiders, by laying eggs. In the fummer months, particularly in the dog days, the tarantula creeping among the corn, bites the mowers and paffengers; but in winter, it lurks in holes, and is feldom feen.

Thus far is true; but now the fable begins: for though the bite is attended with no dangerous fymptoms, and will eafily cure of itfelf, wonderful ftories are reported concerning its virulence. The part which is bitten, as we are told, is foon after difcoloured with a livid black, or yellowifh circle, attended with an inflammation. At firft the pain is fcarcely felt; but

a few hours after, come on a violent ficknefs, difficulty of breathing, fainting, and fometimes trembling. The perfon bit, after this does nothing but laugh, dance and fkip about, putting himfelf into the moft extravagant poftures; and fometimes alfo is feized with a moft frightful melancholy. At the return of the feafon in which he was bit, his madnefs begins again; and the patient always talks of the fame things. Sometimes he fancies himfelf a fhepherd; fometimes a king; appearing entirely out of his fenfes. Thefe troublefome fymptoms fometimes return for feveral years fucceffively, and at laft terminate in death. But fo dreadful a diforder has it feems not been left without a remedy; which is no other than a well played fiddle, For this purpofe the medical mufician plays a particular tune, famous for the cure, which he begins flow, and encreafes in quicknefs as he fees the patient affected. The patient no fooner hears the mufic, but he begins to dance; and continues fo doing till he is all over in a fweat, which forces out the venom that appeared fo dangerous. This dancing fometimes continues for three or four hours, before the patient is weary, and before the fweating is copious enough to cure the diforder. Such are the fymptoms related of the tarantula poifon; fymptoms which

ſome of the beſt and graveſt phyſicians have credited, and attempted to account for. But the truth is, that the whole is an impoſition of the peaſants upon travellers who happen to paſs through that part of the country, and who procure a trifle for ſuffering themſelves to be bitten by the tarantula. Whenever they find a traveller willing to try the experiment, they readily offer themſelves; and are ſure to counterfeit the whole train of ſymptoms which muſic is ſuppoſed to remove. A friend of mine, who paſſed through that part of the country, had a truſty ſervant bitten, without ever adminiſtring the muſical cure: the only ſymptoms were a ſlight inflammation, which was readily removed, and no other conſequence ever attended the bite.—It is thus that falſehoods prevail for a century or two; and mankind at laſt begin to wonder how it was poſſible to keep up the deluſion ſo long.

CHAP. IV.

Of the Flea.

THE hiſtory of thoſe animals with which we are the beſt acquainted, are the firſt objects of our chiefeſt curioſity. There are few but are well informed of the agility and the blood-thirſty diſpoſition of the Flea; of the caution with which it comes to the attack; and the readineſs with which it avoids the purſuit. This inſect, which is not only the enemy of mankind, but of the dog, cat, and ſeveral other animals, is found in every part of the world, but bites with greater ſeverity in ſome countries than in others. Its numbers in Italy and France are much greater than in England; and yet its bite is much more troubleſome here, than I have found it in any other place. It would ſeem that its force encreaſed with the coldneſs of the climate; and though leſs prolific, that it became more predaceous.

If the flea be examined with a microſcope, it will be obſerved to have a ſmall head, large eyes, and a roundiſh body. It has too feelers, or horns, which are ſhort, and compoſed of four joints; and between theſe lies its trunk, which

1. The Flea. } Magnified
2. The Louse. }

C. Martin sculp.

it buries in the ſkin, and through which it ſucks the blood in large quantities. The body appears to be all over curiouſly adorned with a ſuit of poliſhed ſable armour, neatly jointed, and beſet with multitudes of ſharp pins, almoſt like the quills of a porcupine. It has ſix legs, the joints of which are ſo adapted, that it can, as it were, fold them up one within another; and when it leaps, they all ſpring out at once, whereby its whole ſtrength is exerted, and the body raiſed above two hundred times its own diameter.

The young fleas are at firſt a ſort of nits or eggs, which are round and ſmooth; and from theſe proceed white worms, of a ſhining pearl colour: in a fortnight's time they come to a tolerable ſize, and are very lively and active; but if they are touched at this time, they roll themſelves up in a ball: ſoon after this they begin to creep, like ſilk-worms that have no legs; and then they ſeek a place to lie hid in, where they ſpin a ſilken thread from their mouth, and with this they encloſe themſelves in a ſmall round bag or caſe, as white within as writing paper, but dirty without: in this they continue for a fortnight longer; after which they burſt from their confinement perfectly formed, and armed with powers to diſturb the peace of an emperor.

CHAP. V.

Of the Loufe and its Varieties.

THE antipathies of mankind are various; fome confidering the toad, fome the ferpent, fome the fpider, and fome the beetle, with a ftrong degree of deteftation: but while all wonder at the ftrangenefs of each other's averfions, they all feem to unite in their diflike to the Loufe, and regard it as their natural and moft naufeous enemy. Indeed, it feems the enemy of man in the moft odious degree; for wherever wretchednefs, difeafe, or hunger feize upon him, the loufe feldom fails to add itfelf to the tribe, and to encreafe in proportion to the number of his calamities.

In examining the human loufe with the microfcope, its external deformity firft ftrikes us with difguft: the fhape of the fore part of the head is fomewhat oblong; that of the hind part fomewhat round: the fkin is hard, and being ftretched, tranfparent, with here and there feveral briftly hairs: in the fore part is a probofcis or fucker, which is feldom vifible: on each fide of the head are antennæ, or horns, each divided into five joints, covered with briftly hair; and

ſeveral white veſſels are ſeen through theſe horns: behind theſe are the eyes, which ſeem to want thoſe diviſions obſervable in other inſects, and appear encompaſſed with ſome few hairs: the neck is very ſhort, and the breaſt is divided into three parts; on each ſide of which are placed ſix legs, conſiſting of ſix joints covered alſo with briſtly hairs: the ends of the legs are armed with two ſmaller and larger ruddy claws, ſerving thoſe inſects as a finger and thumb, by which they catch hold of ſuch objects as they approach: the end of the body terminates in a cloven tail, while the ſides are all over hairy; the whole reſembling clear parchment, and, when roughly preſſed, cracking with a noiſe.

When we take a cloſer view, its white veins, and other internal parts appear; as likewiſe a moſt wonderful motion in its inteſtines, from the tranſparency of its external covering. When the louſe feeds, the blood is ſeen to ruſh, like a torrent, into the ſtomach; and its greedineſs is ſo great, that the excrements contained in the inteſtines are ejected at the ſame time, to make room for this new ſupply.

The louſe has neither beak, teeth, nor any kind of mouth, as Doctor Hooke deſcribed it; for the entrance into the gullet is abſolutely cloſed. In the place of all theſe, it has a pro-

boſcis or trunk; or, as it may be otherwiſe called, a pointed hollow ſucker, with which it pierces the ſkin, and ſucks the human blood, taking that for food only. This ſtomach is lodged partly in the breaſt and back; but the greateſt portion of it is in the abdomen. When ſwolen with blood, it appears of a dark brown colour, which is viſible through the ſkin; and is either a faint red, or a full or bright brown, as the contents of the ſtomach are more or leſs changed. When it is empty, it is colourleſs; but when filled, it is plainly diſcernible, and its motion ſeems very extraordinary. It then appears working with very ſtrong agitations, and ſomewhat reſembles an animal within an animal. Superficial obſervers are apt to take this for the pulſation of the heart; but if the animal be obſerved when it is ſucking, it will then be found that the food takes a direct paſſage from the trunk to the ſtomach, where the remainder of the old aliment will be ſeen mixing with the new, and agitated up and down on every ſide.

If this animal be kept from food two or three days, and then placed upon the back of the hand, or any ſoft part of the body, it will immediately ſeek for food; which it will the more readily find, if the hand be rubbed till it grows red.

ed. The animal then turns its head, which lies between the two fore legs, to the ſkin, and diligently ſearches for ſome pore : when found, it fixes the trunk therein; and ſoon the microſcope diſcovers the blood aſcending through the head, in a very rapid, and even frightful ſtream. The louſe has at that time ſufficient appetite to feed in any poſture; it is then ſeen ſucking with its head downward, and its tail elevated. If, during this operation, the ſkin be drawn tight, the trunk is bound faſt, and the animal is incapable of diſengaging itſelf; but it more frequently ſuffers from its gluttony, ſince it gorges to ſuch a degree, that it is cruſhed to pieces by the ſlighteſt impreſſion.

Whether lice are diſtinguiſhed by the parts of generation into males, and females, is not yet diſcovered: Swammerdam is inclined to think that they are hermaphrodites, having found an ovary in all thoſe he examined; and he diſſected not leſs than forty-two. In one of theſe animals were found ten large eggs; and forty-four ſmaller, that were not yet come to their full perfection.

There is ſcarce any animal that multiplies ſo faſt as this unwelcome intruder. It has been pleaſantly ſaid, that a louſe becomes a grandfather in the ſpace of twenty-four hours; this

fact cannot be ascertained; but nothing is more true than, that the moment the nit, which is no other than the egg of the louse, gets rid of its superfluous moisture, and throws off its shell, it then begins to breed in its turn. Nothing so much prevents the encrease of this nauseous animal, as cold and want of humidity; the nits must be laid in a place that is warm, and moderately moist, to produce any thing. This is the reason that many nits laid on the hairs in the night-time, are destroyed by the cold of the succeeding day; and so stick for several months, till they at last come to lose even their external form.

The louse is found upon every part of the human body; but particularly in the heads of children. Those found upon the miners in Sweden, are said, by Linnæus, to be very large; and he is of opinion, that the head and the body-louse differ in no respect from each other. The Pthiriasis, or lousy disease, though very little known at present, was frequent enough among the ancients: Herod, Antiochus, Epiphanes, Alcman the poet, Pherecydes, Cassander, Callisthenes and Sylla, all died of this disorder. The use of mercury, which was unknown among the ancients, may probably have banished it from among the moderns: for cer-

tain it is, that those animals seldom attack any in our climate, but such as from sloth or famine invite their company.

Such is the history of the human louse; which, from its connection with mankind, deserves first notice: but it would be endless to describe the various tribes that go under this name, and swarm upon every part of nature. There is scarce an animal, and scarce even a vegetable, that does not suffer under its own peculiar louse. The sheep, the horse, the hog, and the elephant, are all teized by them; the whale, the shark, the salmon, and the lobster, are not without their company; while every hot-house, and every garden is infested with some peculiarly destructive. Linnæus tells us, that he once found a vegetable-louse upon some plants newly arrived from America; and willing to trace the little animal through its various stages, he brought it with him from London to Leyden; where he carefully preserved it during the winter, until it bred in the spring: but the louse it seems did not treat him with all the gratitude he expected; for it became the parent of so numerous a progeny, that it soon overrun all the physic-garden of that beautiful city; and leaves, to this day, many a gardener to curse the Swede's too indulgent curiosity.

The animal which ſome have called the Leaf Louſe, is of the ſize of a flea, and of a bright green, or bluiſh green colour; the body is nearly oval, and is largeſt and moſt convex on the hinder part; the breaſt is very ſmall, and the head is blunt and green: the eyes may be ſeen very plainly, being prominent on the fore part of the head, and of a ſhining black colour; near theſe there is a black line on each ſide; and the legs are very ſlender.

Theſe animals are uſually found upon the leaves of the orache, and other plants; and the weaker the leaves and buds are, theſe inſects ſwarm upon them in greater abundance. Some plants are covered over with them; though they are not the cauſe of the plant's weakneſs, but the ſign: however, by wounding and ſucking the leaf, they increaſe the diſeaſe. They generally aſſume their colour from the plant on which they reſide. Thoſe that feed upon pot-herbs and plum trees, are of an aſh-colour; only they are greeniſh when they are young; thoſe that belong to the alder and cherry-tree, are black; as alſo thoſe upon beans, and ſome other plants: thoſe on the leaves of apples and roſe-trees, are white: but as they leap, like graſshoppers, ſome place them in the number of the flea kind. The moſt uncommon colour

is reddish; and lice of this sort may be found on the leaves of tansey; and their juice, when rubbed in the hands, tinges them with no disagreeable red. All these live upon their respective plant; and are often engendered within the very substance of the leaf.

All these bring forth their young alive; and the fætus, when it is ready to be brought forth, entirely fills the belly of the female; its fore parts being excluded first, and then the hinder. The young one does not begin to move till the horns or feelers appear out of the body of the old one; and by the motion of these it first shews signs of life, moving them in every direction, and bending all their joints. When the horns and head are excluded, the two fore feet follow, which they move with equal agility; after this follow the middle feet, and then the hinder: still, however, the young ones continues sticking to its parent, supported only at one extremity, and hanging as it were in air, until its small and soft members become hardened and fitted for self-support. The parent then gets rid of its burthen; by moving from the place where she was sitting, and forcing the young one to stand upon its legs, leaves it to shift for itself.

As the animal has not far to go, its provision

lying beneath it, during the ſummer it continues to eat and creep about with great agility. But as it is viviparous, and muſt neceſſarily lurk ſomewhere in winter, where its body may be defended from the cold, it endeavours to ſecure a retreat near the trees or plants that ſerve to nouriſh it in the beginning of ſpring. They never hide themſelves in the earth, like many other inſects, becauſe they have no part of their bodies fitted to remove the earth; nor can they creep into every chink, as their legs are too long: beſides, their bodies are ſo tender, that the leaſt rough particle of the earth would hurt them. They therefore get into the deep chinks of the bark, and into the cavities of the ſtronger ſtalks, from whence they ſally out upon the branches and leaves, when the warmth of the ſun begins to be felt. Neither the cold in the autumnal ſeaſon, nor the leſſer degree of heat in the ſping, ever hurts them; they ſeldom, therefore, ſeek for hiding-places before the fall of the leaf, and are alert enough to take the earlieſt advantage of the returning ſpring.

Like many others inſects, they caſt their ſkins four ſeveral times; and, what is very remarkable, the males have four wings, but the females never have any. They all have long legs, not only to enable them to creep over the long hairs of

plants and leaves, but alſo to travel from one tree to another, when they happen to ſtand at a diſtance. Their trunk or ſnout lies under their breaſt; and this they thruſt into the pores of the plant to ſuck out the juice, for they do not gnaw them like the caterpillar; but ſo hurt them by ſucking, that the leaves become ſpotted, and as it were overrun with ſcabs; for which reaſon their edges always turn up towards the middle.

It has been ſaid, that theſe inſects are often carried away and devoured by ants; but this Fryſch, from whom this deſcription is taken, could never obſerve. The ants indeed are fond of thoſe trees where there is a great number of thoſe inſects; but then it is only to ſuck the juice which flows from the leaves that have been juſt wounded. This more particularly happens in the heat of ſummer, when other moiſture is wanting: however, he never found them hurting or carrying away any of theſe inſects while alive; nor indeed were they able, for the leaf louſe is more than a match for the ant at ſingle combat. Whenever they perceive the ant approaching behind them, they kick back with their hinder feet, and thus drive off the invader, as a horſe would a lion.

The three principal and conſtant enemies to

thefe infects are firft, the fire-flie, which lays its eggs where thefe infects are in greateft number, which producing a worm, feizes and devours all the leaf lice that come near it: another enemy is the worm of a peculiar kind of beetle, which deftroys them in great numbers: but the moft formidable of all enemies, is the ichneumon fly, that feizes upon one of the largeft females, and laying its egg upon her, this is hatched into a worm, which foon devours and deftroys the animal from whofe body it fprung.

CHAP.

CHAP. VI.

Of the Bug and its Varieties.

THE Bug is another of thoſe nauſeous inſects that intrude upon the retreats of mankind; and often baniſh that ſleep, which even ſorrow and anxiety permitted to approach. This, to many men, is, of all other inſects, the moſt troubleſome and obnoxious. The night is uſually the ſeaſon when the wretched have reſt from their labour; but this ſeems the only ſeaſon when the bug iſſues from its retreats, to make its depredations. By day it lurks, like a robber, in the moſt ſecret parts of the bed; takes the advantage of every chink and cranny, to make a ſecure lodgment; and contrives its habitation with ſo much art, that ſcarce any induſtry can diſcover its retreat. It ſeems to avoid the light with great cunning; and even if candles be kept burning, this formidable inſect will not iſſue from its hiding-place. But when darkneſs promiſes ſecurity, it then iſſues from every corner of the bed, drops from the teſter, crawls from behind the arras, and travels with great aſſiduity to the unhappy patient, who vainly wiſhes for reſt and refreſhment. It is

generally vain to deſtroy one only, as there are hundreds more to revenge their companion's fate; ſo that the perſon who thus is ſubject to be bitten, remains the whole night like a centinel upon duty, rather watching the approach of freſh invaders, than inviting the pleaſing approaches of ſleep.

Nor are theſe inſects leſs diſagreeable from their nauſeous ſtench, than their unceaſing appetites. When they begin to crawl, the whole bed is infected with the ſmell; but if they are accidentally killed, then it is inſupportable.

Theſe are a part of the inconveniences that reſult from the perſecution of theſe odious inſects: but happily for Great Britain, they multiply leſs in theſe iſlands, than in any part of the continent. In France and Italy the beds, particularly in their inns, ſwarm with them; and every piece of furniture ſeems to afford them a retreat. They grow larger alſo with them than with us, and bite with more cruel appetite.

This animal, if examined minutely, appears to conſiſt of three principal parts; the head, the corſelet, and the belly. It has two brown eyes, that are very ſmall, and a little prominent, beſides two feelers, with three joints: underneath theſe there is a crooked trunk, which is its inſtrument of torture, and which, when in motion,

lies close upon the breast. The breast is a kind of ring, in which are placed the two first pair of legs. The belly consists of nine rings; under which are placed two pair of legs more, making six in all. Each leg has three joints, which form the thigh, the leg, and the foot, which is armed with a crooked claw, like an hook. The body is smooth, except a few short hairs, that may be seen by the microscope, about the vent, and on the two last rings. Its motion is slow and unwieldy; yet its sight is so exquisite, that the instant it perceives the light, it generally makes good its retreat; and they are seldom caught, though the bed swarms with them.

If we examine this insect internally, we shall find the great artery, which in all insects performs the functions of the heart; we shall find the apertures of the lungs on the right side and the left, through which the animal breathes; we shall find a stomach and intestines, which, as in other animals, run from the mouth to the anus. If the insect has been kept long fasting, there will be a mucus found in its body, like the white of an egg; but if crushed after a full meal, the human blood, which it has sucked in, will appear a little darkened by having passed through the insect's body.

The male and female of these animals are

plainly diſtinguiſhable from each other; and the parts of generation are obvious enough. They are often found coupling tail to tail; and in this ſtate are very eaſily deſtroyed. The female has an ovary filled with eggs, joined together like a bunch of grapes; each egg being oblong, almoſt cylindrical, inclining to white, and pretty tranſparent. In about two days after impregnation by the male, ſhe depoſits her eggs to the number of about an hundred and fifty, in ſome convenient place where they are like to receive no diſturbance. There they continue for ſome months; during which time, neither cold nor heat, neither moiſture nor fumigation, can in the leaſt retard their excluſion; but they come forth active, and ready for miſchief. It is this hardineſs in the ſhell that ſeems to continue the breed; as the old ones die every winter, or are eaſily deſtroyed by any fumigation that is uſed for that purpoſe. But the eggs ſeem incapable of deſtruction; even thoſe men who make a livelihood by killing theſe nauſeous inſects, though they can anſwer for the parent, can never be ſure of the egg. For this reaſon they uſually pay thoſe houſes to which they are called a ſecond or a third viſit, and at laſt exterminate them by perſeverance.

The manner of deſtroying them ſeems rather

the effects of aſſiduity than antidote; for the men called in upon this occaſion, take every part of the furniture aſunder, bruſh every part of it with great aſſiduity, anoint it with a liquid, which I take to be a ſolution of corroſive ſublimate, and having performed this operation twice or thrice, the vermin are moſt uſually deſtroyed.

Cleanlineſs, therefore, ſeems to be the beſt antidote to remove theſe nauſeous inſects; and wherever that is wanting, their encreaſe ſeems but a juſt puniſhment. Indeed, they are ſometimes found in ſuch numbers among old furniture, and neglected chambers, expoſed to the ſouth, that, wanting other ſuſtenance, they devour each other. They are alſo enemies to other vermin, and deſtroy fleas very effectually; ſo that we ſeldom have the double perſecution of different vermin in the ſame bed. Of the bug kind Linnæus reckons up forty.

CHAP.

CHAP. VII.

Of the Wood-Loufe and its Varieties.

THE common Wood-Loufe is feldom above half an inch long, and a quarter of an inch broad. The colour is of a livid black, efpecially when found about dung-hills, and on the ground; but thofe that are to be met with under tiles, and in drier places, are of the colour of the hair of an afs. It has fourteen feet, feven on each fide; and they have only one joint each, which is fcarcely perceivable. It has two fhort feelers, and the body is of an oval fhape. When it is touched, it rolls itfelf up into a fort of a ball; and the fides, near the feet, are dentated, like a faw. It is often found among rotten timber, and on decayed trees: in winter it lies hid in the crevices of walls and all forts of buildings. The male is eafily diftinguifhable from the female, being lefs, and more flender. The eggs they lay are white and fhining, like feed pearls, and are very numerous: however, more properly fpeaking, although, when excluded, the young have all the appearance of an egg, yet they are alive, and, without throwing off any fhell, ftir and

move about with great vivacity; so that this animal may properly be said to be viviparous. The little worms at first seem scarce able to stir; but they soon feed, and become very brisk. These animals are of great use in medicine: being impregnated with a saline quality, which is diuretic and stimulating. Of this insect Linnæus makes three species.

CHAP. VIII.

Of the Monoculus, or Arborefcent Water-Flea.

THIS animal, which is of the fize of a flea, appears to the fight, unaffifted by the microfcrope, to have but one eye; for the eyes, by reafon of the fmallnefs of the head, feem to be joined to each other: they are fituated in the trunk of this infect, and the beak is likewife very fmall and fharp pointed. The ftructure of the eye is feen by the microfcope, to be reticulated, or made like a net; and the trunk of this infect, by which it feeds, is not only fmall and fharp, but alfo tranfparent. The infects are of a blood red colour; and fometimes are feen in fuch multitudes on the furface of ftanding water, as to make them appear all over red, whence many fanciful people have thought the water to be turned into blood.

Swammerdam tell us of a celebrated profeffor of Leyden, who was at firft aftonifhed by an appearance of this kind. Being once intent upon his ftudies, he heard a noife, of which, as it increafed by degrees, he was defirous to know the caufe. The maid-fervant attending to his fummons, appeared quite petrified with

fear, and told him, with a tremulous voice, that all the waters of Leyden were turned into blood. Upon this he went directly in a ſmall bark to the place where the water was thus changed, and put ſome of the bloody water into a glaſs; but upon viewing it with attention, he obſerved, that it abounded with infinite numbers of theſe little red inſects, which tinged the whole body of the fluid with that ſeemingly formidable colour. Thus his ſudden fright was changed into laſting admiration.

Of all parts of this animal, its branching arms, and the motion it makes with them in the water, deſerve our greateſt attention. By theſe the little creature can move in a ſtraight line; waving its arms, as a bird does its wings in the air, ſometimes upward, ſometimes downward, ſometimes to the right, ſometimes to the left, yet ſtill continuing to proceed in a right line. By ſtriking the water with its arms, it can aſcend with great velocity; and by ſtriking in a contrary direction, it dives with equal eaſe. As theſe motions are very rapid, the little animal appears to jump in the water, its head always tending to the ſurface, and its tail ſtretched downward. This inſect is produced from an egg, which, when excluded, is carried on the back of the female, and ſoon is ſeen

floating in the water round her. Its appearance at firft is that of a very fmall whitifh infect, endued with a very nimble motion. Except in colour, it fuffers no change, only continuing to grow larger and redder, as it grows old. They fometimes remain feveral days on the furface of the water; and fometimes are feen at the bottom only; but they are never at reft. They change their fkin, like moft other infects; and the caft fkin refembles the infect itfelf fo exactly, that one might miftake the mafk for the animal.

CHAP.

CHAP. IX.

Of the Scorpion and its Varieties.

THERE is ſcarce an inſect without wings that is not obnoxious to man: the ſmalleſt have the power of annoying him, either by biting or ſtinging him; and though each is in itſelf contemptible, they become formidable from their numbers. But of all this claſs, there is none ſo terrible as the Scorpion, whoſe ſhape is hideous, whoſe ſize among the inſect tribe is enormous, and whoſe ſting is generally fatal. Happy for England, the ſcorpion is entirely a ſtranger among us! In ſeveral parts of the continent of Europe it is but too well known, though it ſeldom grows above four inches long: but in the warm tropical climates, it is ſeen a foot in length, and in every reſpect as large as a lobſter.

The ſcorpion is one of the largeſt of the inſect tribe, and not leſs terrible from its ſize than its malignity. It reſembles a lobſter ſomewhat in ſhape, but is infinitely more hideous. There have been enumerated nine different kinds of this dangerous inſect, chiefly diſtinguiſhed by their colour: there being ſcorpions

yellow, brown, and aſh-coloured; others that are the colour of ruſty iron, green, pale yellow, black, claret colour, white, and grey.

There are four principal parts diſtinguiſhable in this animal; the head, the breaſt, the belly, and the tail. The ſcorpion's head ſeems, as it were, jointed to the breaſt; in the middle of which are ſeen two eyes; and a little more forward, two eyes more, placed in the fore part of the head: theſe eyes are ſo ſmall, that they are ſcarcely perceivable; and is is probable the animal has but little occaſion for ſeeing. The mouth is furniſhed with two jaws; the undermoſt is divided into two, and the parts notched into each other, which ſerves the animal as teeth, and with which it breaks its food, and thruſts it into its mouth: theſe the ſcorpion can at pleaſure pull back into its mouth, ſo that no part of them can be ſeen. On each ſide of the head are two arms, each compoſed of four joints; the laſt of which is large, with ſtrong muſcles, and made in the manner of a lobſter's claw. Below the breaſt are eight articulated legs, each divided into ſix joints; the two hindmoſt of which are each provided with two crooked claws, and here and there covered with hair. The belly is divided into ſeven little rings; from the loweſt of which is continued a

tail, composed of six joints, which are bristly, and formed like little globes, the last being armed with a crooked sting. This is that fatal instrument which renders this insect so formidable: it is long, pointed, hard, and hollow; it is pierced near the base by two small holes, through which, when the animal stings, it ejects a drop of poison, which is white, caustic, and fatal. The reservoir in which this poison is kept, is in a small bladder near the tail, into which the venom is distilled by a peculiar apparatus. If this bladder be gently pressed, the venom will be seen issuing out through the two holes above-mentioned; so that it appears, that when the animal stings, the bladder is pressed, and the venom issues through the two apertures into the wound.

There are few animals more formidable, or more truly mischievous than the scorpion. As it takes refuge in a small place, and is generally found sheltering in houses, so it cannot be otherwise than that it must frequently sting those among whom it resides. In some of the towns of Italy, and in France, in the province of Languedoc, it is one of the greatest pests that torment mankind: but its malignity in Europe is trifling, when compared to what the natives of Africa, and the East, are known to experience.

In Batavia, where they grow twelve inches long, there is no removing any piece of furniture, without the utmoſt danger of being ſtung by them. Boſman aſſures us, that, along the Gold Coaſt, they are often found larger than a lobſter; and that their ſting is inevitably fatal. In Europe, however, they are by no means ſo large, ſo venomous, or ſo plentiful. The general ſize of this animal does not exceed two or three inches; and its ſting is very ſeldom found to be fatal. Maupertuis, who made ſeveral experiments on the ſcorpion of Languedoc, found it by no means ſo invariably dangerous as had till then been repreſented. He provoked one of them to ſting a dog, in three places of the belly, where the animal was without hair. In about an hour after the poor animal ſeemed greatly ſwolen, and became very ſick: he then caſt up whatever he had in his bowels; and, for about three hours, continued vomiting a whitiſh liquid. The belly was always greatly ſwolen, when the animal began to vomit; but this operation always ſeemed to abate the ſwelling; which alternately ſwelled, and was thus emptied, for three hours ſucceſſively. The poor animal, after this, fell into convulſions, bit the ground, dragged himſelf along upon his fore feet, and at laſt died, five hours after being bitten. He was not partially

ſwolen round the place which was bitten, as is uſual after the ſting of a waſp or a bee; but his whole body was inflated, and there only appeared a red ſpot on the places where he had been ſtung.

Some days after, however, the ſame experiment was tried upon another dog, and even with more aggravated cruelty; yet the dog ſeemed no way affected by the wounds, but howling a little when he received them, continued alert and well after them; and ſoon after was ſet at liberty, without ſhewing the ſmalleſt ſymptoms of pain. So far was this poor creature from being terrified at the experiment, that he left his own maſter's houſe, to come to that of the philoſopher, where he had received more plentiful entertainment. The ſame experiment was tried by freſh ſcorpions, upon ſeven other dogs, and upon three hens; but not the ſmalleſt deadly ſymptom was ſeen to enſue. From hence it appears, that many circumſtances, which are utterly unknown, muſt contribute to give efficacy to the ſcorpion's venom. Whether its food, long faſting, the ſeaſon, the nature of the veſſels it wounds, or its ſtate of maturity, contribute to, or retard its malignity, is yet to be aſcertained by ſucceeding experiment. In the trials made by our philoſopher, he em-

ployed ſcorpions of both ſexes, newly caught and ſeemingly vigorous and active. The ſucceſs of this experiment may ſerve to ſhew that, many of thoſe boaſted antidotes which are given for the cure of the ſcorpion's ſting, owe their ſucceſs rather to accident than their own efficacy. They only happened to cure, when their ſting was no way dangerous; but in caſes of actual malignity, they might probably be utterly unſerviceable.

The ſcorpion of the tropical climates being much larger than the former, is probably much more venomous. Helbigius, however, who reſided for many years in the Eaſt, aſſures us, that he was often ſtung by the ſcorpion, and never received any material injury from the wound: a painful tumour generally enſued; but he always cured it, by rubbing the part with a piece of iron or ſtone, as he had ſeen the Indians practiſe before him, until the fleſh became inſenſible. Seba, Moore, and Boſman, however, give a very different account of the ſcorpion's malignity; and aſſert that, unleſs ſpeedily relieved, the wound becomes fatal.

It is certain that, no animal in the creation ſeems endued with ſuch an iraſcible nature. I have often ſeen them taken and put into a place of ſecurity, exerting all their rage againſt the

ſides of the glaſs veſſel that contained them. I have ſeen them attempt to ſting a ſtick, when put near them; and attack a mouſe or a frog, while thoſe animals were far from offering any injury. Maupertuis put three ſcorpions and a mouſe into the ſame veſſel together, and they ſoon ſtung the little animal in different places. The mouſe, thus aſſaulted, ſtood for ſome time upon the defenſive, and at laſt killed them all, one after another. He tried this experiment, in order to ſee whether the mouſe, after it had killed, would eat the ſcorpions; but the little quadrupede ſeemed entirely ſatisfied with the victory, and even ſurvived the ſeverity of the wounds it had received. Wolkamer tried the courage of the ſcorpion againſt the large ſpider, and encloſed ſeveral of both kinds in glaſs veſſels, for that purpoſe *. The ſucceſs of this combat was very remarkable. The ſpider at firſt uſed all its efforts to immeſh the ſcorpion in its web, which it immediately began ſpinning; but the ſcorpion reſcued itſelf from the danger, by ſtinging its adverſary to death: it ſoon after cut off, with its claws, all the legs of the ſpider, and then ſucked all the internal parts at its leiſure.—If the ſcorpion's ſkin had not been ſo hard, Wolkamer is of opinion that the ſpider would have

* Ephemerides. Dec. ii. 1687. Obſerv. 224.

obtained the victory; for he had often feen one of thefe fpiders deftroy a toad.

The fierce fpirit of this animal is equally dangerous to its own fpecies; for fcorpions are the cruelleft enemies to each other. Maupertuis put about an hundred of them together in the fame glafs; and they fcarce came into contact, when they began to exert all their rage in mutual deftruction: there was nothing to be feen but one univerfal carnage, without any diftinction of age or fex; fo that, in a few days, there remained only fourteen, which had killed and devoured all the reft.

But their unnatural malignity is ftill more apparent, in their cruelty to their offspring. He enclofed a female fcorpion, big with young, in a glafs veffel, and fhe was feen to devour them as faft as they were excluded: there was but one only of the number that efcaped the general deftruction, by taking refuge on the back of its parent; and this foon after revenged the caufe of its brethren, by killing the old one in its turn.

Such is the terrible and unrelenting nature of this infect, which neither the bonds of fociety, nor of nature can reclaim: it is even afferted that, when driven to an extremity, the fcorpion will often deftroy itfelf. The following expe-

riment was ineffectually tried by Maupertuis: but I am ſo well aſſured of it by many eye-witneſſes, who have ſeen it both in Italy and America, that I have no doubt remaining of its veracity. A ſcorpion, newly caught, is placed in the midſt of a circle of burning charcoal, and thus an egreſs prevented on every ſide: the ſcorpion, as I am aſſured, runs for about a minute round the circle, in hopes of eſcaping; but finding that impoſſible, it ſtings itſelf on the back of the head, and in this manner the undaunted ſuicide inſtantly expires.

It is happy for mankind that theſe animals are thus deſtructive to each other; ſince otherwiſe they would multiply in ſo great a degree as to render ſome countries uninhabitable. The male and female of this inſect are very eaſily diſtinguiſhable; the male being ſmaller and leſs hairy. The female brings forth her young alive, and perfect in their kind. Redi having bought a quantity of ſcorpions, ſelected the females, which by their ſize and roughneſs were eaſily diſtinguiſhable from the reſt, and putting them in ſeparate glaſs veſſels, he kept them for ſome days without food. In about five days one of them brought forth thirty-eight young ones, well ſhaped, and of a milk-white colour, which changed every day more and

more into a dark rusty hue. Another female, in a different vessel, brought forth twenty-seven of the same colour; and the day following the young ones seemed all fixed to the back and belly of the female. For near a fortnight all these continued alive and well; but afterwards some of them died daily: until, in about a month, they all died, except two.

Were it worth the trouble, these animals might be kept living as long as curiosity should think proper. Their chief food is worms and insects; and upon a proper supply of these, their lives might be lengthened to their natural extent. How long that may be we are not told; but if we may argue from analogy, it cannot be less than seven or eight years; and perhaps, in the larger kind, double that duration. As they have somewhat the form of the lobster, so they resemble that animal in casting their shell, or more properly their skin; since it is softer by far than the covering of the lobster, and set with hairs, which grow from it in great abundance, particularly at the joinings. The young lie in the womb of the parent, each covered up in its own membrane, to the number of forty or fifty, and united to each other by an oblong thread, so as to exhibit altogether the form of a chaplet.

Such is the manner in which the common ſcorpion produces its young: but there is a ſcorpion of America, produced from the egg, in the manner of the ſpider. The eggs are no larger than pins points; and they are depoſited in a web, which they ſpin from their bodies, and carry about with them, till they are hatched. As ſoon as the young ones are excluded from the ſhell, they get upon the back of the parent, who turns her tail over them, and defends them with her ſting. It ſeems probable, therefore, that captivity produces that unnatural diſpoſition in the ſcorpion, which induces it to deſtroy its young; ſince, at liberty, it is found to protect them with ſuch unceaſing aſſiduity.

CHAP. X.

Of the Scolopendra and Gally-worm.

OF these hideous and angry insects we know little, except the figure and the noxious qualities. Though with us there are insects somewhat resembling them in form, we are placed at an happy distance from such as are really formidable. With us they seldom grow above an inch long; in the tropical climates they are often found above a quarter of a yard.

The Scolopendra is otherwise called the Centipes, from the number of its feet; and it is very common in many parts of the world, especially between the tropics. Those of the East-Indies, where they grow to the largest size, are about six inches long, of a ruddy colour, and as thick as a man's finger: they consist of many joints; and from each joint is a leg on each side: they are covered with hair, and seem to have no eyes; but there are two feelers on the head, which they make use of to find out the way they are to pass: the head is very round, with two small sharp teeth, with which they inflict wounds that are very painful and dangerous. A sailor that was bit by one on board

a ſhip, felt an exceſſive pain, and his life was ſuppoſed to be in danger: however, he recovered, by the application of three roaſted onions to the part; and was ſoon quite well. Of this animal there are different kinds; ſome living, like worms, in holes in the earth; others under ſtones, and among rotten wood: ſo that nothing is more dangerous than removing thoſe ſubſtances, in the places where they breed.

The Gally-worm differs from the ſcolopendra, in having double the number of feet; there being two on each ſide, to every joint of the body. Some of theſe are ſmooth, and others hairy; ſome are yellow, ſome black, and ſome brown. They are found among decayed trees, between the wood and the bark; as alſo among ſtones that are covered with moſs. They all, when touched, contract themſelves, rolling themſelves up like a ball. Whatever may be their qualities in the tropical parts of the world, in Europe they are perfectly harmleſs; having been often handled and irritated, without any vindictive conſequences.

All theſe, as well as the ſcorpion, are ſuppoſed to be produced perfect from the parent, or the egg; and to undergo no changes, after their firſt excluſion. They are ſeen of all ſizes;

and this is a ſufficient inducement to ſuppoſe, that they preſerve their firſt appearance, through the whole of their exiſtence. It is probable however, that, like moſt of this claſs, they often change their ſkins; but of this we have no certain information.

CHAP. XI.

Of the Leech.

THE last of this winglefs tribe that I fhall mention is the Leech, which, like all the former, undergoes no varieties of transformation; but when once excluded from the body of the parent, preferves its firft figure to the end. I place the hiftory of the leech among the firft clafs of infects; while I have degraded the Earth-worm, the Tænia, and the Polypus, into the clafs of zoophytes, or that imperfect tribe which ferves to make the fhade between animal and vegetable nature. Not but that the earth-worm or the polypus have their motions, their appetites, and their vital principles, as complete as the leech, and to a curfory view appear every way as complete animals. But there is one circumftance that lays the line between them; that exalts the one and degrades the other. The earth-worm and the polypus may be cut into pieces, and each piece will produce a new and perfect animal; the leech cannot fuffer this diffection, but dies when cut in two; an evident inftance that it is poffeffed of a more

perfect organization than those animals which it otherwise very much resembles.

The leech, from its uses in medicine, is one of those insects that man has taken care to provide; but of a great variety, one kind only is considered as serviceable. The horse-leech, which is the largest of all, and grows to four inches in length, with a glossy black surface, is of no use, as it will not stick to the skin; the snail-leech is but an inch in length; and though it will stick, is not large enough to extract a sufficient quantity of blood from the patient; the broad-tailed leech, which grows to an inch and an half in length, with the back raised into a sort of a ridge, will stick but on very few occasions: it is the large brown leech, with a whitish belly, that is made use of in medicine, and whose history best merits our curiosity.

The leech has the general figure of a worm, and is about as long as one's middle finger. Its skin is composed of rings, by means of which it is possessed of its agility, and swims in water. It contracts itself, when out of water, in such a manner, that when touched it is not above an inch long. It has a small head, and a black skin, edged with a yellow line on each side, with some yellowish spots on the back. The belly also, which is

of a reddiſh colour, is marked with whitiſh yellow ſpots. But the moſt remarkable part of this animal is the mouth, which is compoſed of two lips, that take whatever form the inſect finds convenient. When at reſt, the opening is uſually triangular; and within it are placed three very ſharp teeth, capable of piercing not only the human ſkin, but alſo that of an horſe or an ox. Still deeper in the head, is diſcovered the tongue, which is compoſed of a ſtrong fleſhy ſubſtance, and which ſerves to aſſiſt the animal in ſucking, when it has inflicted its triple wound; for no ſooner is this voracious creature applied to the ſkin, than it buries its teeth therein, then cloſes its lips round the wound which it has made; and thus, in the manner of a cupping-glaſs, extracts the blood as it flows to the different orifices.

In examining this animal's form farther towards the tail, it is ſeen to have a gullet and an inteſtinal canal, into which the blood flows in great abundance. On each ſide of this are ſeen running along ſeveral little bladders, which, when the animal is empty, ſeem to be filled with nothing but water; but when it is gorging blood, they ſeem to communicate with the inteſtines, and receive a large portion of the blood which flows into the body. If theſe bladders ſhould be

confidered as fo many ftomachs, then every leech will be found to have twenty-four. But what is moft extraordinary of all in this animal's formation is, that though it takes fo large a quantity of food, it has no anus or paffage to eject it from the body when it has been digefted. On the contrary, the blood which the leech has thus fucked remains for feveral months clotted within its body, blackened a little by the change, but no way putrefied, and very little altered in its texture or confiftence. In what manner it paffes through the animal's body, or how it contributes to its nourifhment, is not eafily accounted for. The water in which they are kept is very little difcoloured by their continuance; they cannot be fuppofed to return the blood by the fame paffage through which it was taken in; it only remains, therefore, that it goes off through the pores of the body, and that thefe are fufficiently large to permit its exclufion.

But it is not in this inftance alone that the leech differs from all other infects. It was remarked in a former chapter, that the whole infect tribe had the opening into their lungs placed in their fides; and that they breathed through thofe apertures as other animals through the mouth. A drop of oil poured on the fides

of a waſp, a bee, or a worm, would quickly ſuffocate them, by ſtopping up the paſſages through which they breathe; but it is otherwiſe with the leech, for this animal may be immerſed in oil without injury; nay, it will live therein; and the only damage it will ſuſtain is, that when taken out it will be ſeen to caſt a fine pellucid ſkin exactly of the ſhape of the animal, after which it is as alert and vigorous as before. It appears from hence that the leech breathes through the mouth; and, in fact, it has a motion that ſeems to reſemble the act of reſpiration in more perfect animals: but concerning all this we are very much in the dark.

This animal ſeems to differ from all others in ſeveral reſpects; the reſt of the reptile tribe are brought forth from eggs; the leech is viviparous, and produces its young one after the other, to the number of forty or fifty at a birth. It is probable that, like the ſnail, each inſect contains the two ſexes, and that it impregnates and is impregnated in the ſame manner. The young ones are chiefly found in the month of July, in ſhallow running waters, and particularly where they are tepified by the rays of the ſun. The large ones are chiefly ſought after; and being put into a glaſs veſſel

filled with water, they remain for months, nay for years, without taking any other subsistence. But they never breed in this confinement; and, consequently, what regards that part of their history still remains obscure.

In this part of the world they seldom grow to above four inches; but in America and the East they are found from six to seven. Their pools there abound with them in such numbers, that it would be dangerous bathing there, if for no other consideration. Our sailors and soldiers, who the last war were obliged to walk in those countries through marshy grounds, talk with terror of the number of leeches that infested them on their march. Even in some parts of Europe they increase so as to become formidable. Sedelius, a German physician, relates, that a girl of nine years old, who was keeping sheep near the city of Bomst in Poland, perceiving a soldier making up to her, went to hide herself in a neighbouring marsh among some bushes; but the number of leeches was so great in that place, and they stuck to her so close, that the poor creature expired from the quantity of blood which she lost by their united efforts. Nor is this much to be wondered at, since one of those insects that when empty generally weighs but a scruple, will, when gorged, weigh more than two drachms.

When leeches are to be applied, the beſt way is to take them from the water in which they are contained about an hour before, for they thus become more voracious and faſten more readily. When ſaturated with blood, they generally fall off of themſelves; but if it be thought it neceſſary to take them from the wound, care ſhould be uſed to pull them very gently, or even to ſprinkle them with ſalt if they continue to adhere; for if they be plucked rudely away, it moſt frequently happens that they leave their teeth in the wound, which makes a very troubleſome inflammation, and is often attended with danger. If they be ſlow in fixing to the part, they are often enticed by rubbing it with milk or blood, or water mixed with ſugar. As ſalt is a poiſon to moſt inſects, many people throw it upon the leech when it has dropped from the wound, by which means it diſgorges the blood it has ſwallowed, and it is then kept for repeated application. They ſeldom, however, ſtick after this operation; and as the price is but ſmall, freſh leeches ſhould always be applied whenever ſuch an application is thought neceſſary.

AN
HISTORY
OF
INSECTS.

PART II.

CHAP. I.

Of the fecond Order of Infects.

IN the former part we gave a concife hiftory of the moft confiderable infects that, without wings, were produced in a perfect ftate; either from the body of the parent alive, like quadrupedes, or from the egg, in the manner of birds. We come now to a fecond order of infects, that are produced from the egg, like the former, but not in a perfect ftate; for when firft excluded, they are without wings. This, however, does not hinder the exercife of their animal functions; the infect, although not yet come to perfection, walks, leaps, and eats; nor is it ever deprived of motion, only that it refts a little when it is about to caft that part of its fkin previous to its ftate of perfection. It is then feen to affume two wings, which, like a budding flower, burft through the cafe that contained them, and the animal becomes a winged infect in its ftate of higheft perfection. To this order we may refer the Libella, or Dragon-Fly; the Formica Leo, or Lion-Ant; the Grafhopper; the Locuft; the Cricket; the Wood-Cricket; the Mole-Cricket; the Flea-Locuft; the Flying-Bug; the Tipula; the Water-Scorpion; the Notonecta, or Water-Fly, and many others.

CHAP. II.

Of the Libella or Dragon-Fly.

OF all the flies which adorn or diverſify the face of Nature, theſe are the moſt various and the moſt beautiful; they are of all colours; green, blue, crimſon, ſcarlet, white; ſome unite a variety of the moſt vivid tints, and exhibit in one animal more different ſhades than are to be found in the rainbow. They are called, in different parts of the kingdom, by different names; but none can be at a loſs to know them, as they are diſtinguiſhed from all other flies by the length of their bodies, by the largeneſs of their eyes, and the beautiful tranſparency of their wings, which are four in number. They are ſeen in ſummer flying with great rapidity near every hedge, and by every running brook; they ſometimes ſettle on the leaves of plants, and ſometimes keep for hours together on the wing.

Dragon-flies, though there are three or four different kinds, yet agree in the moſt ſtriking parts of their hiſtory, and one account may ſerve for all. The largeſt ſort are generally found from two to three inches long; their tail

is forked; their body divided into eleven rings; their eyes are large, horny, and tranſparent, divided by a number of interſections; and their wings, that always lie flat when they are at reſt, are of a beautiful gloſſy tranſparency; ſometimes ſhining like ſilver, and ſometimes gliſtening like gold. Within the mouth are to be ſeen two teeth covered with a beautiful lip: with theſe the creatures bite fiercely when they are taken; but their bite is perfectly harmleſs, as I have experienced more than once.

Theſe inſects, beautiful as they are, are produced from eggs, which are depoſited in the water, where they remain for ſome time without ſeeming life or motion. They are ejected by the female into the water in cluſters, like a bunch of grapes, where they ſink to the bottom by their natural weight, and continue in that ſtate till the young ones find ſtrength enough to break the ſhell, and to ſeparate from each other. The form in which they firſt ſhew life is that of a worm with ſix legs, bearing a ſtrong reſemblance to the dragon-fly in its winged ſtate, except that the wings are yet concealed within a ſheath peculiar to this animal. The rudiments of theſe appear in bunches on the back, within which the wings are folded up into each other, while all the colours and

varieties of painting appear tranſparent through the ſkin. Theſe animals, upon quitting the egg, ſtill continue in the water, where they creep and ſwim, but do not move ſwiftly. They have likewiſe a ſharp ſight, and immediately ſink to the bottom, if any one comes to the places wherein they live, or whenever they perceive the leaſt uncommon object. Their food at that time is ſoft mud and the glutinous earthy ſubſtances that are found at the bottom.

When theſe animals prepare to change from their reptile to their flying ſtate, they then move out of the water to a dry place; as into graſs; to pieces of wood, ſtone, or any thing elſe they meet with. They there firmly fix their acute claws; and, for a ſhort time, continue quite immoveable, as if meditating on the change they are to undergo. It is then obſerved, that the ſkin firſt opens on the head and back; and out of this opening they exhibit their real head and eyes, and at length their ſix legs; whilſt, in the mean time, the hollow and empty ſkin, or ſlough of their legs, remains firmly fixed in its place. After this, the encloſed creature creeps forward by degrees; and by this means draws firſt its wings and then its body out of the ſkin; and proceeding a little

farther, sits at rest for some time, as if immoveable. During this time, the wings, which were moist and folded, begin by degrees to expand themselves, and to make smooth and even all those plaits which were laid against each other, like a closed fan. The body is likewise insensibly extended, until all the limbs have obtained their proper size and dimensions. All these surprising and difficult operations are accomplished by the force of the blood and the circulating humours. The creature cannot at first make use of its new wings, and therefore is forced to stay in the same place until all its limbs are dried by the circumambient air. It soon, however, begins to enter upon a more noble life than it had hitherto led in the bottom of the brook; and from creeping slowly and living accidentally, it now wings the air, and makes choice from amidst the variety of its provisions.

Indeed, no animal is more amply fitted for motion, subsistence, and enjoyment. As it haunts and seeks after its food flying in the air, Nature has provided it with two large eyes, which make almost the whole head, and which resemble glittering mother of pearl. It has also four expansive silver-coloured wings, with which, as with oars, it can turn itself with pro-

digious velocity; and to affift thefe it is furnifhed with a very long body, which, like a rudder, directs its motions. As the wings are long, and the legs fhort, they feldom walk, but are ever feen either refting or flying. For this reafon, they always chufe dry branches of trees or fhrubs to remain on; and when they have refrefhed themfelves a little, they renew their flight. Thus they are feen, adorning the fummer with a profufion of beauty, lightly traverfing the air in a thoufand directions, and expanding the moft beautiful colours to the fun. The garden, the foreft, the hedges, and the rivulets, are animated by their fports; and there are few who have been brought up in the country, who have not employed a part of their childhood in the purfuit.

But while thefe beautiful flies appear to us fo idly and innocently employed, they are in fact the greateft tyrants of the infect tribe; and, like the hawk among birds, are only hovering up and down to feize their prey. They are the ftrongeft and the moft courageous of all winged infects; nor is there one, how large foever, that they will not attack and devour. The blue fly, the bee, the wafp, and the hornet, make their conftant prey; and even the butterfly, that fpreads fo large a wing, is often caught

and treated without mercy. Their appetite ſeems to know no bounds; they ſpend the whole day in the purſuit, and have been ſeen to devour three times their own ſize in the capture of a ſingle hour. They ſeize their prey flying with their ſix claws, and tear it eaſily to pieces with their teeth, whirh are capable of inflicting troubleſome wounds.

But the males are upon the wing for another purpoſe beſide that of food, as they are very ſalacious, and ſeek the females with great ardour. The ſun no ſooner begins to warm the fields, than the males are found aſſiduouſly employed each in ſeeking its mate; and no ſooner does a female appear, but two or three males are ſeen purſuing and endeavouring to ſeize her with all their arts and agility. The inſtrument of generation in the male is placed very different from that of any other inſect, being not at the end of the tail as in others, but immediately under the breaſt, and conſequently, at firſt view, incapable of being united to the ſexual part of the female; which, as in other inſects, lies in the tail. To perform this junction, Nature has provided the male with a very peculiar manner of proceeding. As ſoon as he perceives the female, and finds himſelf ſufficiently near, he ſeizes upon the back

of her head by surprize, and fastening his claws upon her, turns round his forky tail, which he fastens round her neck, and in this manner fixes himself so closely and firmly, that no efforts can remove him. It is in vain that she flies from one branch to another and settles upon them, he still keeps fixed, and often continues in this situation for three or four hours successively. When he flies, she is obliged to fly with him; but he still directs the way: and though she moves her wings, she seems entirely guided by his motion. As yet, however, the business of impregnation is not performed; for to this the female must contribute; and she at last seems, by the continuance of her constraint, to comply: for, turning up the end of her tail to that part of the breast of the male in which lies the part proper for generation, both instruments meet, and the eggs of the female receive the necessary fecundation. An hour or two after this, she flies to some neighbouring pool, where she deposites her eggs, as was already mentioned. There they continue in a reptile state for a year; and then are changed into a beautiful fly, resembling the parent.

CHAP. III.

Of the Formica Leo, or Lion-Ant.

ALTHOUGH this animal properly belongs to no order of infects, yet, as it is changed into a fly very much refembling that defcribed in the preceding chapter, it may not be improper to give its hiftory here. If we confider the life of this animal in its different ftages of exiftence, we fhall find it equally wonderful in all; but as it changes to a dragon-fly, what we have faid of that animal above need not be repeated here. The lion-ant, when it becomes an inhabitant of air, in every refpect refembles that which has been already defcribed; its gloffy wings, its voracious appetites, its peculiar manner of generation, are entirely the fame. It is in its reptile ftate that it differs from all other infects; and in that ftate it will be amufing to purfue its hiftory.

The lion-ant, in its reptile ftate, is of the fize of a common wood-loufe, but fomewhat broader. It has a pretty long head and a roundifh body, which becomes a little narrower towards the tail. The colour is a dirty grey, fpeckled with black, and the body is compofed

of ſeveral flat rings, which ſlip one upon another. It has ſix feet, four of which are fixed to the breaſt and two to the neck. The head is ſmall and flat, and before there are two little ſmooth horns and feelers, which are hard, about a quarter of an inch long, and crooked at the ends. At the baſis of the feelers there are two ſmall black lively eyes, by which it can ſee the ſmalleſt object, as is eaſily diſcovered by its ſtarting from every thing that approaches.

To a form ſo unpromiſing, and ſo ill provided for the purpoſes of rapacity, this animal unites the moſt ravenous appetites in nature; but to mark its imbecillity ſtill ſtronger, as other animals have wings or feet to enable them to advance towards their prey, the lion-ant is unprovided with ſuch aſſiſtance from either. It has legs indeed; but theſe only enable it to run backward, ſo that it could as ſoon die as make the ſmalleſt progreſſive motion. Thus, famiſhed and rapacious at it ever ſeems, its prey muſt come to it, or rather into the ſnare provided for it, or the inſidious aſſaſſin muſt ſtarve.

But Nature, that has denied it ſtrength or ſwiftneſs, has given it an equivalent in cunning, ſo that no animal fares more ſumptuouſly, without ever ſtirring from it retreat. For this

purpofe, it chufes a dry fandy place, at the foot of a wall, or under fome fhelter, in order to preferve its machinations from the rain. The drieft and moft fandy fpot is the moft proper for it; becaufe a heavy clogged earth would defeat its labour. When it goes about to dig the hole where it takes its prey, it begins to bend the hinder part of its body, which is pointed, and thus works backward; making, after feveral attempts, a circular furrow, which ferves to mark out the fize of the hole it intends making, as the ancients marked out the limits of a city with the plough. Within this firft furrow it digs a fecond; then a third; and afterwards others, which are always lefs than the preceding. Then it begins to deepen its hole, finking lower and lower into the fand, which it throws with its horns, or feelers, towards the edges, as we fee men throw up fand in a gravel-pit. Thus, by repeating its labours all round, the fand is thrown up in a circle about the edge of the pit, until the whole is quite completed. This hole is always formed in a perfect circle; and the pit itfelf refembles the infide of an inverted funnel. When this infect firft leaves the egg and is newly hatched, the firft pit it makes is very fmall; but as it grows bigger, it makes a larger hole; which

is deſtined, like a pit-fall, to entrap its prey. It is generally about two inches deep, and as much in diameter.

The work being thus with great labour finiſhed, the inſidious inſect places itſelf in ambuſh, hiding itſelf in the bottom under the ſand in ſuch a manner, that its two horns encircle the bottom of the pit. All the ſides of this pit-fall are made of the moſt looſe and crumbling materials; ſo that ſcarce any inſect can climb up that has once got down to the bottom. Conſcious of this, the lion-ant remains in patient expectation, ready to profit by that accident which throws ſome heedleſs little animal into his den. If then, by misfortune, an ant, a wood-louſe, or a ſmall caterpillar walks too near the edge of the precipice, the ſand gives way beneath them, and they fall to the bottom of the pit, where they meet inevitable deſtruction. The fall of a ſingle grain of ſand gives the murderer notice at the bottom of its cave; and it never fails to ſally forth to ſeize upon it prey. It happens ſometimes, however, that the ant or the wood-louſe is too nimble, and runs up the ſides of the pit-fall before the other can make ready to ſeize it. The lion-ant has then another contrivance, ſtill more wonderful than the former; for, by means

of its broad head and feelers, it has a method of throwing up a ſhower of ſand which falls upon the ſtruggling captive with tremendous weight, and once more cruſhes it down to the bottom. When the inſect is once fallen thus low, no efforts can retrieve or releaſe it; the lion-ant ſeizes it with its feelers, which are hollow, and darting them both into its body, ſucks out all the little animal's juices with the utmoſt rapacity.

When the prey is thus reduced to a huſk, and nothing but the external form remains, the next care of the murderer is to remove the body from its cell; ſince the appearance of dead carcaſes might forewarn other inſects of the danger of the place. The inſect, therefore, takes up the waſted trunk with its feelers, and throws it, with wonderful ſtrength, at leaſt ſix inches from the edge of its hole; and then patiently ſets about mending the breaches which its fortifications had received in the laſt engagement. Nothing can abate its induſtry, its vigilance, its patience, or its rapacity. It will work for a week together to make its pit-fall; it will continue upon the watch for more than a month, patiently expecting the approach of its prey; and if it comes in greater quantities than is needful, yet ſtill the little voracious creature

will quit the insect it has newly killed, and leave it half eaten, to kill and attack any other that happens to fall within the sphere of its malignity: though so voracious, it is surprisingly patient of hunger; some of them having been kept in a box with sand for six months and upwards, without feeding at all.

When the lion-ant attains a certain age, in which it is to change into another form, it then leaves off its usual rapacious habits, but keeps on its industry. It no longer continues to make pits, but furrows up the sand all round in an irregular manner; testifying those workings and violent agitations which most insects exhibit previous to their transformation. These animals are produced in autumn, and generally live a year, and perhaps two, before they assume a winged form. Certain it is, that they are found at the end of winter of all sizes; and it would seem that many of the smaller kinds had not yet attained sufficient maturity for transformation. Be this as it may, when the time of change approaches, if the insect finds its little cell convenient, it seeks no other: if it is obliged to remove, after furrowing up the sand, it hides itself under it, horns and all. It there spins a thread, in the manner of the spider; which being made of a glutinous substance, and being humid

from the moisture of its body, sticks to the little particles of sand among which it is spun; and in proportion as it is thus excluded, the insect rolls up its web, sand and all, into a ball, of which itself is the center. This ball is about half an inch in diameter; and within it the insect resides, in an apartment sufficiently spacious for all its motions. The outside is composed of sand and silk; the inside is lined with silk only, of a fine pearl colour, extremely delicate, and perfectly beautiful. But though the work is so curious within, it exhibits nothing to external appearance, but a lump of sand; and thus escapes the search of birds, that might otherwise disturb the inhabitant within.

The insect continues thus shut up for six weeks or two months; and gradually parts with its eyes, its feelers, its feet, and its skin; all which are thrust into a corner of the inner apartment, like a rag. The insect then appears almost in its winged state, except that there is a thin skin which wraps up the wings, and that appears to be nothing else but a liquor dried on their outside. Still, however, the little animal is too delicate and tender to venture from its retreat; but continues enclosed for some time longer: at length, when the members of this new insect have acquired the necessary con-

ſiſtence and vigour, it tears open its lodging, and breaks through its wall. For this purpoſe it has two teeth, like thoſe of graſshoppers, with which it eats through, and enlarges the opening, till it gets out. Its body, which is turned like a ſcrew, takes up no more than the ſpace of a quarter of an inch; but when it is unfolded, it becomes half an inch in length; while its wings, that ſeemed to occupy the ſmalleſt ſpace, in two minutes time unfold, and become longer than the body. In ſhort, it becomes a large and beautiful fly of the libellula kind, with a long, ſlender body, of a brown colour; a ſmall head, with large bright eyes, long ſlender legs, and four large tranſparent reticulated wings. The reſt of its habits reſemble that inſect whoſe form it bears; except, that inſtead of dropping its eggs in the water, it depoſites them in ſand, where they are ſoon hatched into that rapacious inſect ſo juſtly admired for its method of catching its prey.

CHAP.

CHAP. IV.

Of the Grafshopper, the Locuft, the Cicada, the Cricket, and the Mole Cricket.

BELONGING to the fecond order of infects, we find a tribe of little animals, which, though differing in fize and colour, ftrongly refemble each other in figure, appetites, nature, and transformation. But though they all appear of one family, yet man has been taught to hold them in different eftimation; for while fome of this tribe amufe him with their chirpings, and banifh folitude from the fields, others come in fwarms, eat up every thing that is green, and in a fingle night convert the moft delightful landfcape into a dreary wafte. However, if thefe animals be feparately confidered, the devouring locuft is not in the leaft more mifchievous than the mufical grafshopper; the only difference is, that one fpecies comes for food in a fwarm, the other feeds fingly.

That animal which is called the grafshopper with us, differs greatly from the cicada of antiquity; for as our infect is active enough in hopping through the long grafs, from whence it has taken its name, the cicada had not this

power, but either walked or flew. The little hissing note also of our grasshopper is very different from the song of the cicada, which was louder and far more musical. The manner in which this note is produced by the two animals is very different; for the cicada makes it by a kind of buckler, which the male has beneath its belly; the grasshopper by a transparent membrane that covers an hole at the base of its wings. There is still a greater variety in all these with regard to shape and colour. Some are green, some black, some livid, and some variegated; but many of them do not shew all their colours till they fly. Some have long legs, some short; some with more joints, others with fewer. Some sing, others are mute; some are innocent, doing no damage to the husbandman; while others do such prodigious mischief, that they are looked upon in some countries as one of the terrible scourges of the incensed Divinity.

Of this variegated tribe, the little grasshopper that breeds in such plenty in every meadow, and that continues its chirping through the summer, is best known to us; and by having its history we shall be possessed of that of all the rest. This animal is of the colour of green leaves, except a line of brown which streaks

the back, and two pale lines under the belly and behind the legs. It may be divided into the head, the corſlet, and the belly. The head is oblong, regarding the earth, and bearing ſome reſemblance to that of a horſe. Its mouth is covered by a kind of round buckler jutting over it, and armed with teeth of a brown colour, hooked at the points. Within the mouth is perceivable a large reddiſh tongue, and fixed to the lower jaw. The feelers or horns are very long, tapering off to a point; and the eyes are like two black ſpecks, a little prominent. The corſlet is elevated, narrow, armed above and below, by two ſerrated ſpines. The back is armed with a ſtrong buckler, to which the muſcles of the legs are firmly bound, and round theſe muſcles are ſeen the veſſels by which the animal breathes, as white as ſnow. The laſt pair of legs are much longer and ſtronger than the firſt two pair, fortified by thick muſcles, and very well formed for leaping. It has four wings; the anterior ones ſpringing from the ſecond pair of legs, the poſterior from the third pair. The hinder wings are much finer and more expanſive than the foremoſt, and are the principal inſtruments of its flight. The belly is conſiderably large, compoſed of eight rings, and terminated by a forky tail, covered with

down, like the tail of a rat. When examined internally, besides the gullet, we discover a small stomach; and behind that a very large one, wrinkled and furrowed within side: lower down there is still a third; so that it is not without reason that all the animals of this order are said to chew the cud, as they so much resemble ruminant animals in their internal conformation.

A short time after the grasshopper assumes its wings, it fills the meadow with its note; which, like that among birds, is a call to courtship. The male only of this tribe is vocal; and, upon examing at the base of the wings, there will be found a little hole in its body, covered with a fine transparent membrane. This is thought, by Linnæus, to be the instrument it emyloys in singing; but others are of opinion the sound is produced by rubbing its hinder legs against each other: however this be, the note of one male is seldom heard, but it is returned by another; and the two little animals, after many mutual insults of this kind, are seen to meet and fight desperately. The female is generally the reward of victory; for, after the combat, the male seizes her with his teeth behind the neck, and thus keeps her for several hours, till the business of fecundation is performed. They are at that time so strongly

united, that they can ſcarcely be ſeparated without tearing aſunder. Towards the latter end of autumn the female prepares to depoſite her burthen; and her body is then ſeen greatly diſtended with her eggs, which ſhe carries to the number of an hundred and fifty. In order to make a proper lodgement in the earth for them, Nature has furniſhed her with an inſtrument at her tail, ſomewhat reſembling a two-edged ſword, which ſhe can ſheathe and unſheathe at pleaſure: with this ſhe pierces the earth as deep as ſhe is able; and into the hole which her inſtrument has made, ſhe depoſites her eggs, one after the other.

Having thus provided for the continuation of her poſterity, the animal herſelf does not long ſurvive; but, as the winter approaches, ſhe dries up, ſeems to feel the effects of age, and dies from a total decay. Some, however, aſſert, that ſhe is killed by the cold; and others, that ſhe is eaten by worms: but certain it is, that neither the male nor female are ever ſeen to ſurvive the winter. In the mean time the eggs which have been depoſited continue unaltered, either by the ſeverity of the ſeaſon, or the retardation of the ſpring. They are of an oval figure, white, and of the conſiſtence of horn: their ſize nearly equals that of a grain of aniſe: they are enve-

loped in the body within a covering, branched all over with veins and arteries; and when excluded, they crack, on being preſſed between the fingers: their ſubſtance within is a whitiſh, viſcous, and tranſparent fluid. In this manner they remain depoſited beneath the ſurface of the earth, during the whole winter; till the genial return of ſpring begins to vivify and hatch them. The ſun, with its warmth, beginning to animate all nature, the inſect eggs feel its benign influence; and generally, about the beginning of May, every egg produces an inſect, about the ſize of a flea. Theſe at firſt are of a whitiſh colour; at the end of two or three days they turn black; and ſoon after they become of a reddiſh brown. They appear, from the beginning, like graſshoppers wanting wings; and hop among the graſs, as ſoon as excluded, with great agility.

Yet ſtill they are by no means arrived at their ſtate of full perfection; although they bear a ſtrong reſemblance to the animal in its perfect form. They want, or ſeem to want, the wings, which they are at laſt ſeen to aſſume; and can only hop among the graſs, without being able to fly. The wings, however, are not wanting, but are concealed within four little bunches, that ſeem to deform the ſides of the animal:

there they lie rolled up in a moſt curious manner; and occupying a ſmaller ſpace than one could conceive who ſaw them extended. Indeed, all inſects, whatever tranſmutations they ſeem to undergo, are yet brought forth with thoſe very limbs, parts and wings, which they afterwards ſeem to acquire. In the moſt helpleſs caterpillar, there is ſtill to be ſeen the rudiments of that beautiful plumage which it afterwards expands when a butterfly; and though many new parts ſeem unfolded to the view, the animal acquires none but ſuch as it was from the beginning poſſeſſed of. The graſshopper, therefore, though ſeemingly without wings, is in reality, from the firſt, poſſeſſed of thoſe inſtruments, and only waits for ſufficient force to break the bonds that hold them folded up, and to give them their full expanſion.

The graſshopper, that for above twenty days from its excluſion has continued without the uſe of its wings, which were folded up to its body, at length prepares for its emancipation, and for a life of greater liberty and pleaſure. To make the proper diſpoſitions for the approaching change, it ceaſes from its graſſy food, and ſeeks about for a convenient place, beneath ſome thorn or thiſtle, that may protect it from an accidental ſhower. The ſame laborious

writhings and workings, heavings and palpitations, which we have remarked in every other insect upon an approaching change, are exhibited in this. It swells up his head and neck; it then seems to draw them in again; and thus alternately, for some time, it exerts its powers to get free. At length, the skin covering the head and breast is seen dividing above the neck; the head is seen issuing out first from the bursting skin; the efforts still continuing, the other parts follow successively; so that the little animal, with its long feelers, legs and all, works its way from the old skin, that remains fixed to the thistle or the thorn. It is, indeed, inconceivable how the insect can thus extricate itself from so exact a sheath as that which covered every part of its body.

The grasshopper, thus disengaged from its outer skin, appears in its perfect form; but then so feeble, and its body so soft and tender, that it may be molded like wax. It is no longer of that obscure colour which it exhibited before, but a greenish white, which becomes more vivid as the moisture on the surface is dried away. Still, however, the animal continues to shew no signs of life, but appears quite spent and fatigued with its labour for more than an hour together. During this time,

the body is drying, and the wings unfolding to their greateſt expanſion; and the curious obſerver will perceive them, fold after fold, opening to the ſun, till at laſt they become longer than the two hinder legs. The inſect's body alſo is lengthened during this operation, and it becomes much more beautiful than before.

Theſe inſects are generally vocal in the midſt of ſummer; and they are heard at ſun-ſetting much louder than during the heats of the day. They are fed upon graſs; and, if their belly be preſſed, they will be ſeen to return the juices of the plants they have laſt fed upon. Though unwilling to fly, and ſlow in flight, particularly when the weather is moiſt or cool, they are ſometimes ſeen to fly to conſiderable diſtances. If they are caught by one of the hinder legs, they quickly diſengage themſelves from it, and leave the leg behind them. This, however, does not grow again, as with crabs or ſpiders; for as they are animals but of a ſingle year's continuance, they have not ſufficient time for repairing thoſe accidental misfortunes. The loſs of their leg alſo prevents them from flying; for, being unable to lift themſelves in the air, they have not room upon the ground for the proper expanſion of their

wings. If they be handled roughly, they will bite very fiercely; and when they fly, they make a noife with their wings. They generally keep in the plain, where the grafs is luxuriant, and the ground rich and fertile: there they depofite their eggs, particularly in thofe cracks which are formed by the heat of the fun.

Such are the habits and nature of thofe little vocal infects, that fwarm in our meadows, and enliven the landfcape. The larger kinds only differ from them in fize, in rapidity of flight, and the powers of injuring mankind, by fwarming upon the productions of the earth. The quantity of grafs which a few grafshoppers that fport in the fields can deftroy is trifling; but when a fwarm of locufts, two or three miles long, and feveral yards deep, fettle upon a field, the confequences are frightful. The annals of every country are marked with the devaftation which fuch a multitude of infects produces; and though they feldom vifit Europe in fuch dangerous fwarms as formerly, yet, in fome of the fouthern kingdoms, they are ftill formidable. Thofe which have at uncertain intervals vifited Europe, in our memory, are fuppofed to have come from Africa, and the animal is called the Great Brown Locuft. It was feen in feveral parts of England in the year 1748, and

many dreadful consequences were apprehended from its appearance. This insect is about three inches long; and has two horns or feelers, an inch in length. The head and horns are of a brownish colour; it is blue about the mouth, as also on the inside of the larger legs. The shield that covers the back is greenish; and the upper side of the body brown, spotted with black, and the under side purple. The upper wings are brown, with small dusky spots, with one larger at the tips; the under wings are more transparent, and of a light brown, tinctured with green, but there is a dark cloud of spots near the tips. This is that insect that has threatened us so often with its visitations; and that is so truly terrible in the countries where it is bred. There is no animal in the creation that multiplies so fast as these, if the sun be warm, and the soil in which their eggs are deposited be dry. Happily for us, the coldness of our climate, and the humidity of our soil, are no way favourable to their production; and as they are but the animals of a year, they visit us and perish.

The Scripture, which was written in a country where the locust made a distinguished feature in the picture of Nature, has given us several very striking images of this animal's numbers

and rapacity. It compares an army, where the numbers are almoſt infinite, to a ſwarm of locuſts: it deſcribes them as riſing out of the earth, where they are produced; as purſuing a ſettled march to deſtroy the fruits of the earth, and co-operate with divine indignation.

When the locuſts take the field, as we are aſſured, they have a leader at their head, whoſe flight they obſerve, and pay a ſtrict attention to all his motions. They appear, at a diſtance, like a black cloud, which, as it approaches, gathers upon the horizon, and almoſt hides the light of the day. It often happens that the huſbandman ſees this imminent calamity paſs away without doing him any miſchief; and the whole ſwarm proceed onward, to ſettle upon the labours of ſome leſs fortunate country. But wretched is the diſtrict upon which they ſettle: they ravage the meadow and the paſture ground; ſtrip the trees of their leaves, and the garden of its beauty: the viſitation of a few minutes deſtroys the expectations of a year; and a famine but too frequently enſues. In their native tropical climates they are not ſo dreadful as in the more ſouthern parts of Europe. There, though the plain and the foreſt be ſtripped of their verdure, the power of vegetation is ſo great, that an interval of three or four days repairs the

calamity: but our verdure is the livery of a season; and we must wait till the ensuing spring repairs the damage. Besides, in their long flights to this part of the world, they are famished by the tediousness of their journey, and are therefore more voracious wherever they happen to settle. But it is not by what they devour that they do so much damage as by what they destroy. Their very bite is thought to contaminate the plant, and to prevent its vegetation. To use the expression of the husbandman, they burn whatever they touch; and leave the marks of their devastation for two or three years ensuing. But if they be noxious while living, they are still more so when dead; for wherever they fall, they infect the air in such a manner that the smell is insupportable. Orosius tells us, that in the year of the world 3800, there was an incredible number of locusts which infected Africa; and, after having eaten up every thing that was green, they flew off and were drowned in the African sea; where they caused such a stench, that the putrefying bodies of hundreds of thousands of men could not equal it.

In the year 1690, a cloud of locusts was seen to enter Russia in three different places; and from thence to spread themselves over

Poland and Lithuania, in ſuch aſtoniſhing multitudes, that the air was darkened, and the earth covered with their numbers. In ſome places they were ſeen lying dead, heaped upon each other four feet deep; in others, they covered the ſurface like a black cloth: the trees bent beneath their weight; and the damage which the country ſuſtained exceeded computation. In Barbary their numbers are formidable, and their viſits are frequent. In the year 1724, Doctor Shaw was a witneſs in that country of their devaſtations. Their firſt appearance was about the latter end of March, when the wind had been ſoutherly for ſome time. In the beginning of April, their numbers were ſo vaſtly increaſed, that in the heat of the day they formed themſelves into large ſwarms, which appeared like clouds, and darkened the ſun. In the middle of May they began to diſappear, retiring into the plains to depoſite their eggs. In the next month, being June, the young brood began to make their appearance, forming many compact bodies of ſeveral hundred yards ſquare; which afterwards marching forward, climbed the trees, walls, and houſes, eating every thing that was green in their way. The inhabitants, to ſtop their progreſs, laid trenches all over their fields and

gardens, filling them with water. Some placed large quantities of heath, ftubble, and fuch like combuftible matter, in rows, and fet them on fire on the approach of the locufts. But all this was to no purpofe; for the trenches were quickly filled up, and the fires put out by the vaft number of fwarms that fucceeded each other. A day or two after one of thefe was in motion, others that were juft hatched came to glean after them, gnawing off the young branches and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their worm-like ftate, by cafting their fkins. To prepare themfelves for this change, they fixed their hinder feet to fome bufh or twig, or corner of a ftone, when immediately, by an undulating motion ufed on this occafion, their heads would firft appear, and foon after the reft of their bodies. The whole transformation was performed in feven or eight minutes time; after which, they were a little while in a languifhing condition; but as foon as the fun and air had hardened their wings, and dried up the moifture that remained after cafting off their floughs, they returned again to their former greedinefs, with an addition both of ftrength and agility. But they did not continue long in this ftate

before they were entirely diſperſed; after laying ther eggs, directing their courſe northward, and probably periſhed in the ſea. It is ſaid that the holes theſe animals make, to depoſite their eggs, are four feet deep in the ground; the eggs are about fourſcore in number, of the ſize of caraway comfits, and bundled up together in cluſters.

It would be endleſs to recount all the miſchiefs which theſe famiſhed inſects have at different times occaſioned; but what can have induced them to take ſuch diſtant flights, when they come into Europe, is not ſo eaſy to be accounted for. It ſeems moſt probable, that by means of a very dry ſeaſon in the heart of Africa, they are propagated in ſuch numbers, that the vegetables of the ſpot where they are produced are not ſufficient to ſuſtain them. Thus being obliged to find out other countries, they traverſe the ſandy deſerts, where they can find no ſuſtenance; ſtill meeting with nothing to allure them from their height, they proceed forward acroſs the ſea, and thus come into Europe, where they alight upon the firſt green paſtures that occur.

In ſome parts of the world, the inhabitants turn what ſeems a plague to their own advantage. Locuſts are eaten by the natives in many

kingdoms of the Eaſt; and are caught in ſmall nets provided for that purpoſe. They parch them over the fire in an earthen pan; and when their wings and legs are fallen off, they turn reddiſh, of the colour of boiled ſhrimps. Dampier has eat them thus prepared, and thinks them a tolerable diſh. The natives of Barbary alſo eat them fried with ſalt; and they are ſaid to taſte like cray-fiſh.

There is a locuſt in Tonquin, about the bigneſs of the top of a man's finger, and as long as the firſt joint. It breeds in the earth, in low grounds; and in the months of January and February, which is the ſeaſon for taking them, they iſſue from the earth in vaſt ſwarms. At firſt they can hardly fly, ſo that they often fall into the rivers in great numbers: however, the natives in theſe months watch the rivers, and take them up in multitudes in ſmall nets. They either eat them freſh, broiled on the coals, or pickle them for keeping. They are conſidered as a great delicacy in that part of the world, as well by the rich as the poor. In the countries where they are eaten, they are regularly brought to market, and ſold as larks or quails in Europe. They muſt have been a common food with the Jews, as Moſes, in the book of Leviticus, permits them to eat

four different kinds of this animal, which he takes care to ſpecify. This diſh, however, has not yet made its way into the kitchens of the luxurious in Europe; and though we may admire the delicacies of the Eaſt, we are as yet happily deprived of the powers of imitation.

Of all animals, however, of this noxious tribe, the Great Weſt-Indian Locuſt, individually conſidered, is the moſt formidable. It is about the thickneſs of the barrel of a gooſe-quill, and the body is divided into nine or ten joints, in the whole about ſix or ſeven inches long. It has two ſmall eyes, ſtanding out of the head like thoſe of crabs, and two feelers like long hair. The whole body is ſtudded with ſmall excreſcences, which are not much bigger than the points of pins. The ſhape is roundiſh, and the body diminiſhes in circumference to the tail, which is forked into two horns. Between theſe, there is a ſort of a ſheath, containing a ſmall dangerous ſting. If any perſon happens to touch this inſect he is ſure to be ſtung; and is immediately taken with a ſhivering and trembling all over the body; which, however, may ſoon be put a ſtop to, by rubbing the place that was affected with a little palm oil.

From the locuſt we deſcend to the cricket,

which is a very inoffensive and pretty animal. Though there be a species of this insect that lives entirely in the woods and fields, yet that with which we are best acquainted is the House-cricket, whose voice is so well known behind a country fire in a winter's evening. There is something so unusual in hearing a sound while we do not see the animal producing it, nor discover the place from whence it comes, that among the country people the chirping of the cricket is always held ominous; and whether it deserts the fire-side, or pays an unexpected visit, the credulous peasantry always find something to be afraid of. In general, however, the killing of a cricket is considered as a most unlucky omen; and though their company is not much desired, yet no methods must be taken to remove them.

The cricket very much resembles the grasshopper in its shape, its manner of ruminating, its voice, its leaping, and methods of propagation. It differs in its colour, which is uniformly of a rusty brown; in its food, which is more various; and in its place of residence, which is most usually in the warmest chinks behind a country hearth. They are, in some measure, obliged to the bad masonry employed in making peasants houses for their retreats.

The ſmalleſt chink ſerves to give them ſhelter; and where they once make their abode they are ſure to propagate. They are of a moſt chilly nature, ſeldom leaving the fire-ſide; and, if undiſturbed, are ſeen to hop from their retreats to chirrup at the blaze in the chimney. The wood-cricket is the moſt timorous animal in nature; but the chimney-cricket being uſed to noiſes, diſregards not only theſe, but the appearance of people near it. Whether the voice of this animal is formed in the ſame manner with that of the graſshopper, by a fine membrane at the baſe of the wings, which is moved by a muſcle, and which being coiled up, gives a ſound like a quail-pipe, is not yet aſcertained; nor do we well know the uſe of this voice, ſince anatomical inſpection has not been able to diſcover the ſmalleſt organs of hearing. Still, however, we can make no doubt of their power of diſtinguiſhing ſounds, though probably not in the ſame manner with the more perfect ranks of nature. Certain it is that I have often heard them call, and this call was as regularly anſwered by another, although none but the males are vocal.

As the cricket lives chiefly in the dark, ſo its eyes ſeem formed for the gloomineſs of its abode; and thoſe who would ſurprize it, have

only to light a candle unexpectedly; by which it is dazzled, and cannot find the way back to its retreat. It is a very voracious little animal, and will eat bread, flower, and meat; but it is particularly fond of sugar. They never drink, but keep for months together at the back of the chimney, where they could possibly have had no moisture. The warmth of their situation only serves to increase their mirth and loquacity. Except in the very coldest weather, they never cease their chirruping, but continue that little piercing note, which is as pleasing to some as it is disagreeable to others. The great Scaliger was particularly delighted with the chirruping of crickets, and kept several of them for his amusement, enclosed in a box, which he placed in a warm situation. Others, on the contrary, think there is something ominous and melancholy in the sound, and use every endeavour to banish this insect from their houses. Ledelius tells us of a woman who was very much incommoded by crickets, and tried, but in vain, every method of banishing them from her house. She at last accidentally succeeded; for having one day invited several guests to her house, where there was a wedding, in order to increase the festivity of the entertainment, she procured drums and

trumpets to entertain them. The noiſe of theſe was ſo much greater than what the little animals were uſed to, that they inſtantly forſook their ſituation, and were never heard in that manſion more.

But of all the cricket kind, that which is called the Mole-Cricket is the moſt extraordinary. This animal is the largeſt of all the inſects with which we are acquainted in this country, being two inches and an half in length, and three quarters of an inch in breadth. The colour is of a duſky brown; and at the extremity of the tail there are two hairy excreſcences, reſembling in ſome ſenſe the tail of a mouſe. The body conſiſts of eight ſcaly joints or ſeparate folds, is brown on the upper part, and more deeply tinged below. The wings are long, narrow, and terminate in a ſharp point, each having a blackiſh line running down it: however, when they are extended, they appear to be much broader than could at firſt ſight be ſuppoſed. The ſhield of the breaſt is of a firm texture, of a blackiſh colour and hairy. The fore-feet, which are this animal's principal inſtruments of burrowing into the earth, are ſtrong, webbed, and hairy; it generally, however, runs backward; but it is commonly under ground, where it burrows even faſter than a

mole. It is thought alſo to be amphibious; and capable of living under water, as well as under ground.

Of all inſects this is the moſt deteſted by gardeners, as it chiefly reſides in that ground which lies light, and where it finds ſufficient plenty under the ſurface. Thus, in a ſingle night's time, it will run along a furrow which has been newly ſown, and rob it of all its contents. Its legs are formed in ſuch a manner that it can penetrate the earth in every direction; before, behind, and above it. At night it ventures from its underground habitation, and, like the cricket, has its chirping call. When the female is fecundated, ſhe makes a cell of clammy earth, the inſide of which is large enough to hold two hazle nuts; and in this ſhe lays her eggs. The whole neſt is about the ſize of a common hen's egg, cloſed up on every ſide, and well defended from the ſmalleſt breath of air. The eggs generally amount to the number of an hundred and fifty, being white, and about the ſize of a carraway comfit. They are thus carefully covered, as well to defend them from the injuries of the weather, as from the attacks of the black-beetle; that being itſelf an underground inhabitant, would, but for this precaution, devour or deſtroy them. To prevent

this, the female mole cricket is often posted as a centinel near the nest, and when the black invader plunges in to seize its prey, the guardian insect seizes him behind, and instantly bites him in two.

Nothing can exceed the care and assiduity which these animals exhibit in the preservation of their young. Wherever the nest is placed, there seems to be a fortification, avenues and entrenchments, drawn round it: there are numberless winding ways that lead to it, and a ditch drawn about it, which few of its insect enemies are able to pass. But their care is not confined to this only; for at the approach of winter they carry their nest entirely away, and sink it deeper in the ground, so that the frost can have no influence in retarding the young brood from coming to maturity. As the weather grows milder, they raise their magazine in proportion; till, at last, they bring it as near the surface as they can, to receive the genial influence of the sun, without wholly exposing it to view: yet, should the frost unexpectly return, they sink it again as before.

CHAP.

CHAP. V.

Of the Earwig, the Froth Infect, and fome others belonging to the fecond Order of Infects.

WE fhould ftill keep in memory that all infects of the fecond order, though not produced quite perfect from the egg, yet want very little of their perfection, and require but a very fmall change to arrive at that ftate which fits them for flight and generation. The natural functions in thefe are never fufpended: from the inftant they leave the egg, they continue to eat, to move, to leap, and purfue their prey: a flight change enfues; a fkin that enclofed a part of their body and limbs, burfts behind, like a woman's ftays, and gives freedom to a fet of wings, with which the animal expatiates, and flies in purfuit of its mate.

Of all this clafs of infects, the earwig undergoes the fmalleft change. This animal is fo common, that it fcarce needs a defcription: its fwiftnefs in the reptile ftate is not lefs remarkable than its indefatigable velocity when upon the wing. That it muft be very prolific, appears from its numbers; and that it is very harmlefs,

every one's experience can readily teſtify. It is provided with ſix feet, and two feelers: the tail is forked; and with this it often attempts to defend itſelf againſt every aſſailant. But its attempts are only the threats of impotence; they draw down the reſentment of powerful animals, but no way ſerve to defend it. The deformity of its figure, and its ſlender make, have alſo ſubjected it to an imputation, which, though entirely founded in prejudice, has more than once procured its deſtruction. It is ſuppoſed, as the name imports, that is often enters into the ears of people ſleeping; thus cauſing madneſs, from the intolerable pain, and ſoon after death itſelf. Indeed, the French name, which ſignifies the Ear-piercer, urges the calumny againſt this harmleſs inſect, in very plain terms: yet nothing can be more unjuſt; the ear is already filled with a ſubſtance which prevents any inſect from entering; and beſides, it is well lined and defended with membranes, which would keep out any little animal, even though the ear-wax were away. Theſe reproaches, therefore, are entirely groundleſs: but it were well if the accuſations which gardeners bring againſt the ear-wig were as ſlightly founded. There is nothing more certain than that it lives among flowers, and deſtroys them. When fruit alſo has been

wounded by flies, the earwig generally comes in for a second feast, and sucks those juices which they first began to broach. Still, however, this insect is not so noxious as it would seem; and seldom is found but where the mischief has been originally begun by others. Like all of this class, the earwig is hatched from an egg. As there are various kinds of this animal, so they chuse different places to breed in: in general, however, they lay their eggs under the bark of plants, or in the clefts of trees, when beginning to decay. They proceed from the egg in that reptile state in which they are most commonly seen; and, as they grow larger, the wings bound under the skin begin to burgeon. It is amazing how very little room four large wings take up before they are protruded; for no person could ever conceive such an expansion of natural drapery could be rolled up in so small a pacquet. The sheath in which they are enveloped, folds and covers them so neatly, that the animal seems quite destitute of wings*; and even when they are burst from their confinement, the animal, by the power of the muscles and joints which it has in the middle of its wings, can closely fold them into a very narrow compass. When the earwig has become a winged insect, it flies in

* Swammerdam, p. 114.

purſuit of the female, ceaſing to feed, and is wholly employed in the buſineſs of propagation. It lives, in its winged ſtate, but a few days; and having taken care for the continuance of poſterity, dries up, and dies, to all appearance conſumptive.

To this order of inſects we may alſo refer the Cuckow Spit, or Froth Worm, that is often found hid in that frothy matter which we find on the ſurface of plants. It has an oblong, obtuſe body; and a large head, with ſmall eyes. The external wings, for it has four, are of a duſky brown colour, marked with two white ſpots: the head is black. The ſpume in which it is found wallowing, is all of its own formation, and very much reſembles frothy ſpittle. It proceeds from the vent of the animal, and other parts of the body; and if it be wiped away, a new quantity will be quickly ſeen ejected from the little animal's body. Within this ſpume it is ſeen in time to acquire four tubercles on its back, wherein the wings are encloſed: theſe burſting, from a reptile it becomes a winged animal; and thus rendered perfect, it flies to meet its mate, and propagate its kind.

The Water Tipula alſo belongs to this claſs. It has an oblong ſlender body, with four feet fixed upon the breaſt, and four feelers near the

mouth. It has four weak wings, which do not at all ſeem proper for flying, but leaping only. But what this inſect chiefly demands our attention for is, the wonderful lightneſs wherewith it runs on the ſurface of the water, ſo as ſcarcely to put it in motion. It is ſometimes ſeen in rivers, and on their banks, eſpecially under ſhady trees; and generally in ſwarms of ſeveral together.

The Common Water-Fly alſo breeds in the ſame manner with thoſe above mentioned. This animal is by ſome called the Notonecta, becauſe it does not ſwim, in the uſual manner, upon its belly, but on its back: nor can we help admiring that fitneſs in this inſect for its ſituation, as it feeds on the under ſide of plants which grow on the ſurface of the water; and therefore it is thus formed with its mouth upwards, to take its food with greater convenience and eaſe.

We may alſo add the Water-Scorpion, which is a large inſect, being near an inch in length, and about half an inch in breadth. Its body is nearly oval, but very flat and thin; and its tail long and pointed. The head is ſmall; and the feelers appear like legs, reſembling the claws of a ſcorpion, but without ſharp points. This inſect is generally found in ponds; and is, of all others the moſt tyrannical and rapacious.

It deſtroys, like a wolf among ſheep, twenty times as many as its hunger requires. One of theſe, when put into a baſon of water, in which were thirty or forty worms of the libellula kind, each as large as itſelf, deſtroyed them all in a few minutes, getting on their backs, and piercing with its trunk through their body. Theſe animals, however, though ſo formidable to others, are nevertheleſs themſelves greatly overrun with a little kind of louſe, about the ſize of a nit, which very probably repays the injury which the water-ſcorpion inflicts upon others.

The water-ſcorpions live in the water by day; out of which they riſe in the duſk of the evening into the air, and ſo flying from place to place, often betake themſelves, in queſt of food, to other waters. The inſect, before its wings are grown, remains in the place where it was produced; but when come to its ſtate of perfection, ſallies forth in ſearch of a companion of the other ſex, in order to continue its noxious poſterity.

CHAP.

CHAP. VI.

Of the Ephemera.

THE laſt inſect we ſhall add to this ſecond order, is the Ephemera; which, though not ſtrictly belonging to it, yet ſeems more properly referred to this rank than any other. Indeed, we muſt not attend to the rigour of method, in an hiſtory where Nature ſeems to take delight to ſport in variety.

That there ſhould be a tribe of flies whoſe duration extends but to a day, ſeems at firſt ſurpriſing; but the wonder will encreaſe, when we are told, that ſome of this kind ſeem to be born and to die in the ſpace of a ſingle hour. The reptile, however, from which they are bred, is by no means ſo ſhort-lived; but is ſometimes ſeen to live two years, and many times three years together.

All ephemeras, of which there are various kinds, are produced from the egg, in the form of worms; from whence they change into a more perfect form; namely, that of aurelias, which is a kind of middle ſtate between a worm and a fly: and from thence they take their laſt mutation, which is into a beautiful fly, of

longer or ſhorter duration, according to its kind.

The ephemera, in its fly ſtate, is a very beautiful winged inſect, and has a ſtrong ſimilitude to the butterfly, both from its ſhape and its wings. It is about the ſize of a middling butterfly; but its wings differ, in not being covered with the painted duſt with which thoſe of butterflies are adorned, and rendered opake, for they are very tranſparent and very thin. Theſe inſects have four wings, the uppermoſt of which are much the largeſt: when the inſect is at reſt, it generally lays its wings one over the other, on the back. The body is long, being formed of ſix rings, that are larger at the origin than near the extremity; and from this a tail proceeds, that is longer than all the reſt of the fly, and conſiſts ſometimes of three threads of an equal length, or ſometimes of two long and one ſhort. To acquire this beautiful form, the inſect has been obliged to undergo ſeveral tranſmutations: but its glory is very ſhort-lived, for the hour of its perfection is the hour of its death; and it ſeems ſcarcely introduced to pleaſure, when it is obliged to part with life.

The reptile that is to become a fly, and that is granted ſo long a term, when compared to its

latter duration, is an inhabitant of the water, and bears a very ſtrong reſemblance to fiſhes, in many particulars; having gills by which it breathes at the bottom, and alſo the tapering form of aquatic animals. Theſe inſects have ſix ſcaly legs, fixed on their corſelet. Their head is triangular; the eyes are placed forward, and may be diſtinguiſhed by their largeneſs and colour. The mouth is furniſhed with teeth; and the body conſiſts of ſix rings; that next the corſelet being largeſt, but growing leſs and leſs to the end: the laſt ring is the ſhorteſt, from which the three threads proceed, which are as long as the whole body. Thus we ſee that the reptile bears a very ſtrong reſemblance to the fly; and only requires wings, to be very near its perfection.

As there are ſeveral kinds of this animal, their aurelias are conſequently of different colours; ſome yellow, ſome brown, and ſome cream-coloured. Some of theſe alſo bore themſelves cells at the bottom of the water, from which they never ſtir out, but feed upon the mud compoſing the walls of their habitation, in contented captivity; others, on the contrary, range about, go from the bottom to the ſurface, ſwim between two waters, quit that element entirely to feed upon plants by the river ſide,

and then return to their favourite element, for ſafety and protection.

The reptile, however, though it lives two or three years, offers but little, in its long duration, to excite curioſity: it is hid at the bottom of the water, and feeds almoſt wholly within its narrow habitation. The moſt ſtriking facts command our attention during the ſhort interval of its fly ſtate; into which it crouds the moſt various tranſactions of its little life. It then may be ſaid to be in a hurry to live, as it has but ſo ſmall a time to exiſt. The peculiar ſign whereby to know that theſe reptiles will change into flies in a ſhort time, conſiſts in a protuberance of the wings on the back. About that time the ſmooth and depreſſed form of the upper part of the body, is changed in a more ſwolen and rounder ſhape; ſo that the wings are in ſome degree viſible through the external ſheath that covers them. As they are not natives of England, he who would ſee them in their greateſt abundance, muſt walk, about ſun-ſet, along the banks of the Rhine, or the Seine, near Paris; where, for about three days, in the midſt of the ſummer, he will be aſtoniſhed at their numbers and aſſiduity. The thickeſt deſcent of the flakes of ſnow in winter ſeems not to equal their number; the whole air ſeems alive

with the new-born race, and the earth itſelf is all over covered with their remains. The aurelias, or reptile inſects, that are as yet beneath the ſurface of the water, wait only for the approach of evening to begin their transformation. The moſt induſtrious ſhake off their old garments about eight o'clock; and thoſe who are the moſt tardy, are transformed before nine.

We have already ſeen that the operation of change in other inſects is laborious and painful; but with theſe nothing ſeems ſhorter, or performed with greater eaſe. The aurelias are ſcarce lifted above the ſurface of the water, than their old ſheathing ſkin burſts; and through the cavity which is thus formed, a fly iſſues, whoſe wings, at the ſame inſtant, are unfolded, and at the ſame time lift it into the air. Millions and millions of aurelias, riſe in this manner to the ſurface; and at once become flies, and fill every quarter with their flutterings. But all theſe ſports are ſhortly to have an end; for as the little ſtrangers live but an hour or two, the whole ſwarm ſoon fall to the ground, and covers the earth, like a deep ſnow, for ſeveral hundred yards, on every ſide of the river. Their numbers are then incredible, and every object they touch becomes fatal to them; for they inſtantly die, if they hit againſt even each other.

At this time the males and females are very differently employed. The males, quite inactive and apparently without desires, seem only born to die: no way like the males of other insects; they neither follow the opposite sex, nor bear any enmity to each other: after fluttering for an hour or two, they drop upon land, without seeming to receive wings for scarce any other purpose but to satisfy an idle curiosity. It is otherwise with the females; that are scarce risen from the surface of the water, and have dried their wings, but they hasten to drop their eggs back again. If they happen also to flutter upon land, they deposit their burthen in the place where they drop. But then it may be demanded, where and in what manner are these eggs fecundated, as no copulation whatever appears between the sexes, in their transitory visits in air? Swammerdam is of opinion, that they are impregnated in the manner of fish-spawn, by the male, after being ejected by the female: but, beside that this doctrine is exploded even from the history of fishes, it is certain, that the males have not time for this operation, as the eggs drop to the bottom the instant they are laid on the water. Reaumur is of opinion that they copulate; but that the act bears a proportion in shortness to the small duration of their lives;

and consequently, must be so soon performed, as to be scarcely visible. This, however, is at best forcing a theory; and, it is probable, that as there are many insects known to breed without any impregnation from the male, as we have already seen in muscles and the oysters, and shall hereafter see in the gnat, and a species of the beetle, so the ephemera may be of this number. Be this as it may, the females are in such haste to deposite their eggs, that multitudes of them fall to the ground; but the greatest part are laid in the water. As they flutter upon the surface, two clusters are seen issuing from the extremity of their body, each containing about three hundred and fifty eggs, which make seven hundred in all. Thus, of all insects, this appears to be the most prolific; and it would seem that there was a necessity for such a supply, as, in its reptile state, it is the favourite food of every kind of fresh-water fish. It is in vain that these little animals form galleries at the bottom of the river, from whence they seldom remove; many kinds of fish break in upon their retreats, and thin their numbers. For this reason fishermen are careful to provide themselves with these insects, as the most grateful bait; and thus turn the fish's rapacity to its own destruction.